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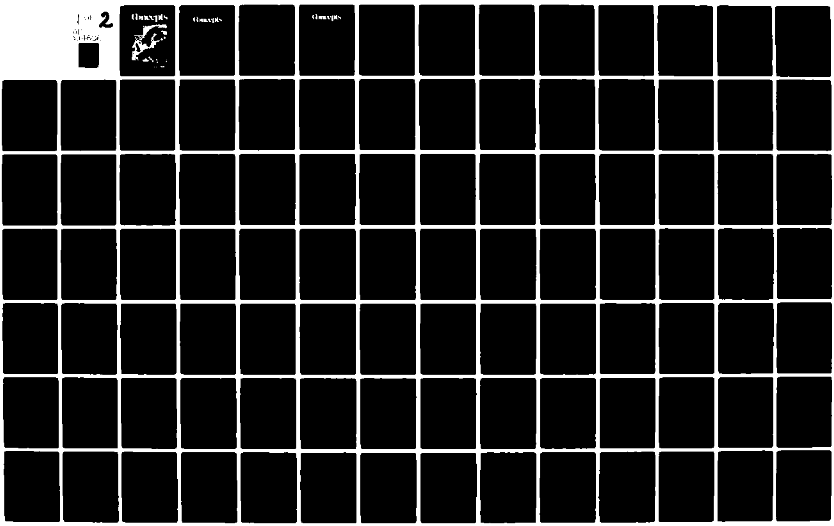

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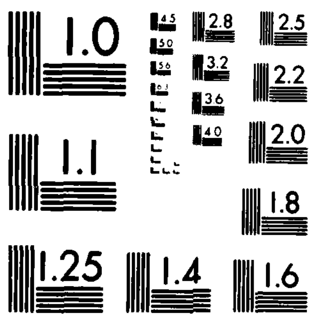

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

Concepts

The Journal of
Defence Systems
Acquisition Management

Winter 1982
Volume 5
Number 1

EUROPEAN OVERVIEW
Competition,
Education,
Taxation

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a general comment . . .

As the sixth Commandant of the Defense Systems Management College, I look forward to providing the best education and assistance to our military and civilian acquisition managers. Since 1971, the College has established an enviable reputation as the Department of Defense focal point for advanced education in the field of systems acquisition management. Over its first 10 years, the College responded vigorously to the needs and challenges established by the Office of the Secretary of Defense, and took a proactive role both in the definition of defense acquisition policy and in the implementation of this policy. It is my objective to support and foster this proactive nature of the College's interactions with the acquisition community. There is no other organization in the Department of Defense that is better qualified or in a better position to perform this mission.

To this end, I have challenged each member of the College staff and faculty to establish and nurture even more vigorous relationships with the nation's major defense acquisition programs. And I invite the readership to take advantage of the tremendous resource we have here at Fort Belvoir. At the same time, I am leading the College in a thoughtful examination of techniques by which we can make the College an even more valuable resource to the acquisition community.

I am also focusing my energies on improving the acquisition process itself. The Department of Defense Acquisition Improvement Program, initiated by Deputy Secretary of Defense Frank C. Carlucci's 30 April 1981 memorandum, is a clear blueprint of the challenges for the 1980s and a call to action for each of us. As Commandant of the College I have accepted the challenge to significantly improve the acquisition process through implementation of the decisions in the Acquisition Improvement Program, and am leading the College in a frontal assault on the elements of the acquisition process which make it more costly and time consuming than it should be.

It is with great pleasure and great anticipation that I join this outstanding institution, and I look forward to interacting and working with each of you.

Benjamin J Pellegrini

BENJAMIN J. PELLEGRINI
Brigadier General, USA
Commandant

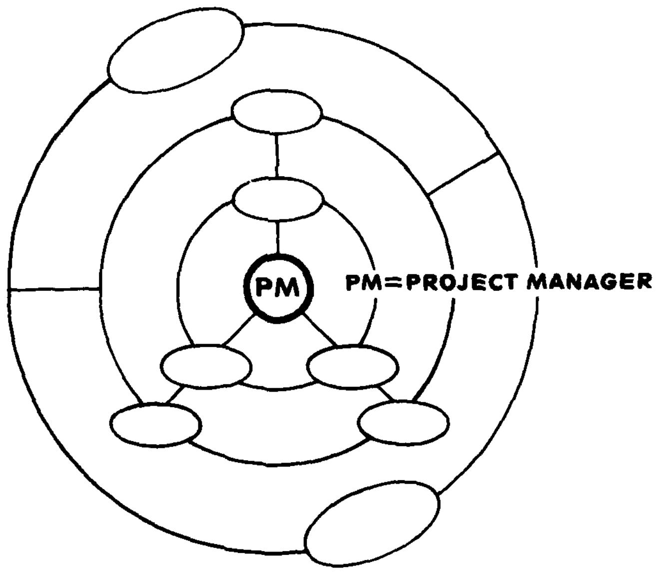
7

European Overview Part I: Competition, Education, Taxation

Dr. Franz A. P. Frisch

If you are selected—in government or industry—to be the manager of an international project of defense acquisition, you have a right to feel proud: You must be one of the best, and you have been assigned to a position with immense challenges and opportunities—but also tremendous difficulties. Nevertheless, you have the right to consider yourself as the center of the world. And here you are in the center, in the middle of the illustration (Figure 1), surrounded by a maze of bubbles as yet undefined.

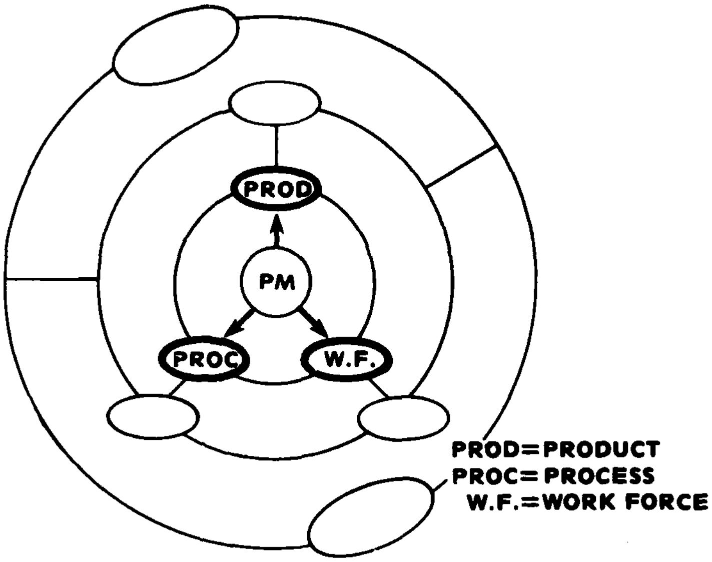
FIGURE 1
The Management Maze



Dr. Franz A. P. Frisch is Professor Emeritus of the Defense Systems Management College and Adjunct Professor at Virginia Polytechnic Institute and State University. He has 30 years' experience in shipbuilding and related subjects in Austria, Denmark, Sweden, Germany, and the United States. Dr. Frisch holds engineering degrees from the Technical University of Vienna, Austria.

Now you will search for *your* system. Without hesitation, you define your system this way: "This what I control," with double emphasis on the "I." You *think* you control (1) the product (PROD), (2) the process (PROC), or how the product is produced, and (3) the work force (WF), as well as some of the other factors of production. We can now begin to fill in the shadow figures of our illustration (Figure 2).

FIGURE 2
The Management Elements

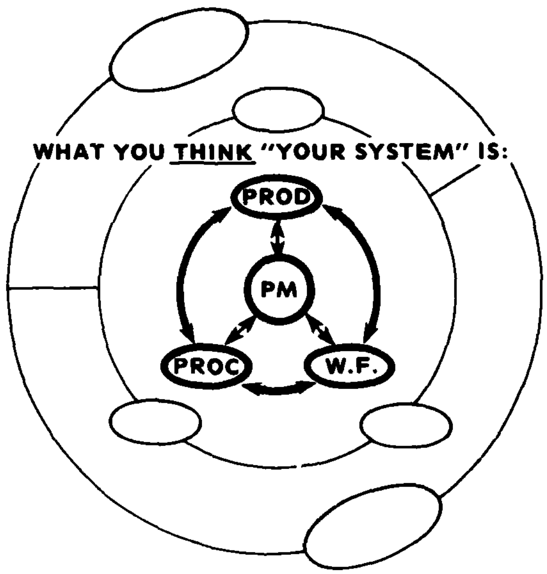


But you soon discover that the three elements are interrelated, and you control only a part—believe me, a very small part. We may portray the interrelationships of your perceived system as shown in Figure 3.

The two-directional arrows indicate that not only do you "try" to control your system, but also that the system exerts control over you. What you really control may only be a part of your perceived system, as illustrated in Figure 4.

This is not intended to depress you, rather it is to have you recognize that the product, the process, and the work force are only in part members of your system. You must accept the fact that all that you do *not* control, but all that con-

FIGURE 3
Interrelationship of Elements

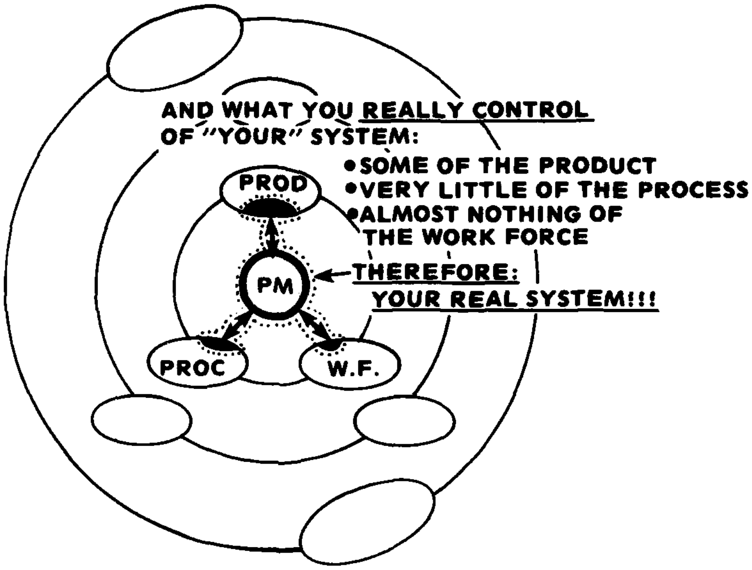


trols *you*, is a part of your environment. If you recognize this, the fun starts and the question of the day shifts from "How do I control the system?" to "How do I live with my environment?" The better you understand your environment, the better it is for you. So let us design the *measurable environment* around your system (Figure 5).

You will discover first that the "product" is the response to the market as determined by military need. Next you will see that the process to build the product will depend upon the resources (capital, raw material, energy, knowledge) of the builder and, finally, that the work force is the product of the general education in the country in which your product is built. Altogether, you will find that the "military need" can be satisfied with many solutions or technical responses, and that the Europeans are unashamed to use socio-economic criteria or attributes to choose among alternatives.

The measurable environment may not be too problematic for you. If you study some national industrial and education statistics, you might adequately

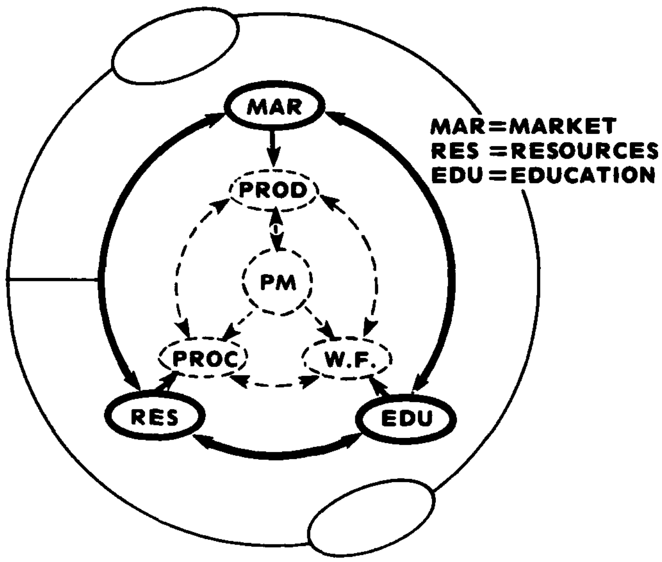
FIGURE 4
Reality



understand what is going on. Unfortunately, understanding the measurable environment is only part of your problem—and, presumably, the smallest part. Much more importantly, you need to understand the *non-measurable environment* of your international operation: culture, attitudes, human behavior, national priorities, and all the other subtleties which ultimately drive the measurable environment and, in turn, your system. This, the unmeasurable environment, is the area of unlimited surprises. It is the area where you and your foreign friends may use the same words, but with different meaning; it is the area of so-called "cultural shock."

My problem here is how to explain all this in a limited amount of space. I could recommend that you read Peter Drucker's management books; he relates many well-written stories of how management operates in the United States, in Europe, and in Japan. I could tell you sea stories from my own experience of how you can get almost everything in some places in Europe, provided you are introduced by a friend of a friend, and how no door will open without such an intro-

FIGURE 5
The Measurable Environment

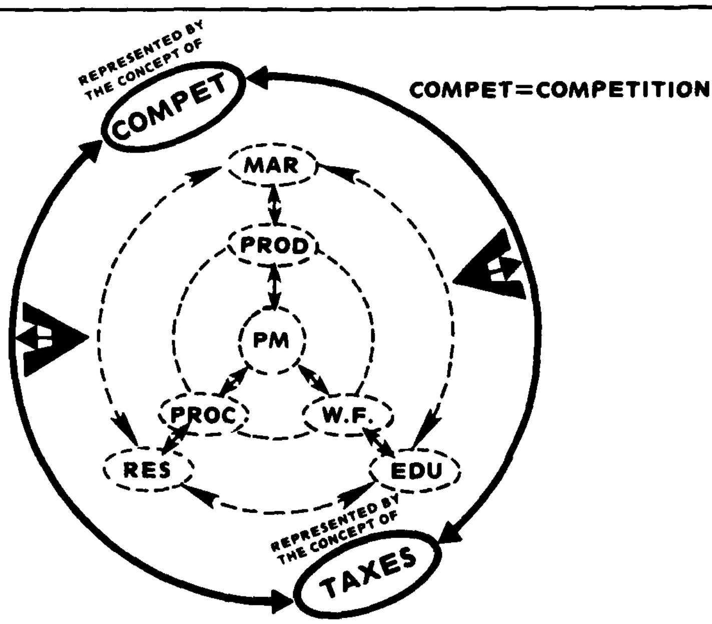


duction. I could tell you about places in South America where no one will talk to you seriously if he does not know your family history and your education in utmost detail—however where almost everything can be settled at a dinner party as soon as he trusts you as a human being. I could tell you sea stories from negotiations in Japan and with shrewd Russians and not-less-alert Arabians. This all may be very interesting—but also most confusing. However, let me assure you, I have never found purposefully dishonest people; maybe I am naive or I have not a streak of paranoia. Hence, I recommend that when you deal in foreign countries, you do not export a paranoic attitude. Nobody will try to buy you off with a dinner party, but many will expect you to invite them, in due time, to one. How you do this with a government expense account is, of course, your headache; but the business atmosphere, the business climate, has many different shades around the world. And this "other climate," these other attitudes, are embedded in the mist of the non-measurable environment, ingrained in history, tradition, or what is often called the "culture" of a nation.

How do we explain this environment? First, let us sketch in the circle of the non-measurable environment (Figure 6) around our measurable environment, and let us search for more tangible elements that may help us condense the culture and viewpoints of foreign countries to manageable proportions. I suggest selecting two elements: the concept of *competition* and the concept of *taxes*.

The first element and its history will give you some understanding of why most foreign countries have a rather mercantilistic attitude, an attitude more oriented toward the protective aspects of business than toward the competitive aspects as in the United States. I selected taxes as the second element because I believe that the tax structure reveals the intellectual habits, the true thinking, of a nation better and more clearly than any social rhetoric. A nation may cherish socialistic rhetoric but tax like a convinced capitalist, or it may be full of capitalistic rhetoric but tax in the socialistic manner of the disciples of Marx and Lenin. Hence, if you look at a tax structure of a nation, where the money comes

FIGURE 6
The Non-Measurable Environment



from and where it goes, you come close to the heart of a nation's true thinking about priorities, values, and other subtleties.

Now let me summarize my plan for this European overview: First I will discuss *competition*; next, I will talk about *education*, which provides the talents and the work force for European industry; and, finally, I will review the subject of *taxes*.

Caveat and Rules

Before I begin I must impress upon you three caveats. First, you must remember that the Europe I will talk about is a construct, an *idealized model*. It is not quite France, but neither is it quite Germany, or Switzerland, or Austria. The model is actually a composite of them and almost fully reflects each of them. The model covers North and Middle Europe quite well, less the Deep South and the British territories. Here the model is somewhat off center, but still not off target. You have to keep in mind that Europe is not a homogenous, monolithic block. Europe is a conglomerate, a colorful mosaic of languages, cultures, and traditions; only from a distant viewpoint may Europe appear as a unit. If I talk about European competition, education, and especially taxes, I will bring you the European commonalities, but not the idiosyncrasies.

Second, please keep in mind that space limitations force me to use brute simplifications. Finally, I must emphasize that in order to speak about Europe, I have to use the American model as a baseline. This is done for expedience and should not be taken to mean that any one system is superior to another. Therefore I beg you, let us never state that this or that system in education, competition, or taxation is better than any other. Let us just record the differences without declared preferences or value judgments. Let us try to understand what makes European industry tick, what drives it, what motivates it. I ask you to take this discussion as an eye-opener, as a pointer to alertness, and as a guide for your own search into the wonderland of cultural pluralities.

DESCRIPTION OF EUROPEAN VIEWS ON COMPETITION, EDUCATION AND TAXATION

Competition

When you go to Europe, you will notice that the Europeans do not believe in competition out of principle, and that most Europeans are rather neutral to the idea, especially in the defense industry. Almost as a rule, the government-industrial relationships are very cozy. But so are the relationships between in-

dustry management and the workers' union; in turn, workers' unions and government institutions are often almost indistinguishable. Workers are organized by trades, and so are the industries and shops of small proprietors. In Portugal under Salazar and in Austria under Dollfuss and Schuschnig prior to 1938, the entire government was structured around guilds, following the recommendation of the *Quadragesimo Anno*—the papal recommendation for state and social organizations.

Although the *Quadragesimo Anno* was a revival and amplification of an historical tradition, the fact remains that even today the guild system is a strong force in the infrastructure of the European economy. In the Middle Ages, it was the European medieval form of industrial organization. During the early industrialization of Europe, the guilds were the depository of technological know-how, the seed for many small industries, and the breeding ground for the skilled work force.

Today, as in the past, the guilds of mechanics, butchers, barbers, plumbers, electricians, etc., almost *ad infinitum* have two functions: First they protect the standard of performance, guaranteed by a 4-year apprenticeship and at least a 4-year journeymanship, closing with a guild-supervised examination which certifies the master position in a trade. Being certified as a master in a trade ensures, even today, a respected social position. Additionally, only a master in a trade has the right to open his own trade shop and hire and train new apprentices and journeymen—a right that cannot be bestowed upon holders of a master's or Ph.D. degree from a university. The master diploma in a trade puts the worker in a unique position; he has pledged his work, uncompromisingly, to quality, but he is also cast into a rather narrow role. His chances for expansion beyond his own shop in one location are very limited. To balance this disadvantage, the second function comes into play. The second function compensates him for his chosen, but rather limited, role: It protects him from competition by giving him a territory (like a franchise). Another tradesman can open a shop within that territory only with the first tradesman's consent. The result of this guild mechanism is a non-competitive infrastructure in each European nation with an amazingly even quantitative distribution and high quality standards. Today, this guild concept is applied in modified form to lawyers, the medical profession, veterinarians, and professional engineers, thus avoiding concentrations and securing services even in areas remote from city centers. In theory, this guild system does not rule out competition, because the customer is free to choose—at least as long as he can walk to the tradesman's shop—but if the customer wants to build a house, he might not have any choice than to go to his local carpenter, plumber, and electrician.

In short, large parts of the European population are raised in a quasi-protective, non-competitive environment. Hence, the concept of competition as we know it in the United States is essentially unknown to the European mentality, even in the non-guild-related industrial activities where the push for expansion is a search for a non-competitive niche in the economy rather than a push into someone else's territory. Hand in hand with this non-competitive atmosphere goes a formidable loyalty to the once-selected profession (and company), and few companies expend capital for investment purposes into alien arenas. One large electric company, for example, may very well buy out other electric companies or might integrate vertically, but will never go into the agricultural business just for the sake of the investment opportunity. This attitude, combined with the absence of any antitrust law, has helped to form in Europe many almost monopolistic structures, but abuses of such structures are neither feared nor documented. Abuses of monopolistic power in the non-competitive environment may be too tempting to nationalization and government control—a process quite amicable to most European minds. The frequently formed cartels (trusts) are vertical organized trusts and the almost standard form of the European industrial organizations. Cartels often split the market among their members by type of product and by quantity; quite frequently they form joint enterprises to develop export markets, especially new markets of the Third World. In addition, most, if not all, cartels are controlled, financed, and supported by a few major banks sharing the risk of expansion and exploration—a situation quite similar to Japan.

You may like or dislike the European attitude toward competition. The fact remains, however, that no fierce competition exits among the Europeans, and most definitely not in the defense market. Hence, when you search for competitive bidding in Europe you might be in for some surprises. What the Europeans have done, essentially, is to rationalize their defense industry according to their economic need, the first and utmost priority for all Europeans.

As a final remark on competition: All retail prices in Europe, as a rule, are determined by the manufacturer. A car, a TV set, or a camera has the same price at a retailer in front of the factory as in the remotest place in the country, and also the same price in a small shop or at a large department store. Competition, then, in the retail sector is shifted to quality of service and selection, but it is unknown with regard to price. Doctors' fees, hospital fees, and the cost of schooling are also out of the area of competition because of government regulations, like transport fees and building codes. All of these are areas of fierce competition in the United States, but are non-competitive in the usual sense in Europe. Even time is a non-competitive element in Europe; almost everywhere shops are closed from

noon to 2 p.m., and are open only until 6 or 7 p.m. during the week and until 1 p.m. on Saturday—no exception, no competition! Like it or not, this is Europe. What it all boils down to is that the entire incentive system and the *modus operandi* of motivation is different in Europe—for better or for worse.

Education

The best way to "understand" a foreign country is to learn as much as you can about its school system, about the educational philosophy, and the structure of education. Schools are where the young generations are molded, indoctrinated, and tailored to fit the expectations of the older generations. And even when children revolt, they let free those feelings the older generations would never dare to expose, at least during their waking hours. Therefore, if you know the children, you might understand the parents. You will understand why the old Europeans are so conscious of titles and, from the American viewpoint, so unrelaxed and stiff. But are they really—or does it appear so only to us? Let us start at the beginning.

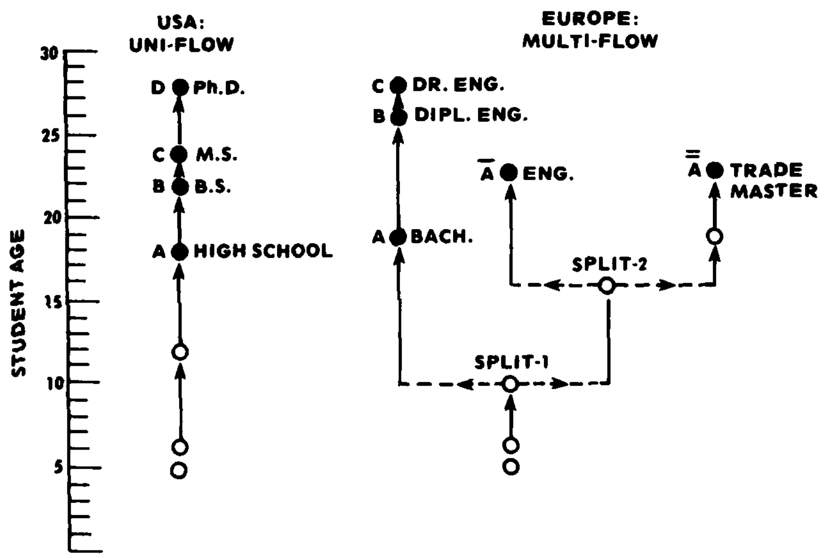
If I had to sum up the differences between American and European schools in a single sentence, I would say that American schools are *egalitarian, pragmatic, and competitive* while European schools are *elitist, humanistic, and non-competitive.* These are, of course, six dangerous words, loaded with emotion and with preconceived opinions. Furthermore, each of these six words is highly ambiguous. With regard to structure, I would describe the American system as a *uniflow* and the European system as a *multiflow*—two other terms that need explanation. As a commonality I would state that both systems catch the tender offspring at the age of 5 or 6 and release them some time before their 30s with a Ph.D. of equal quality. But in between those fulcrums there are no two other comparable points in the continuum of progressive education from the starting line to the lofty heights.

To bring this into better focus, let us start with a few European facts, which will give the discussion form and direction. (1) Education, up to the Ph.D. level, is (for all practical purposes) free of cost throughout Europe. (2) Government mercilessly controls the entrance and/or exit examinations at different stages of learning. (3) "Social" promotions are unknown, and only the best students are admitted to the entrance examinations for higher school types. (4) The attrition rates in higher schools, including universities, are staggering. (5) The examinations in higher schools are given on a *de facto*, pass/fail basis and do not determine a student's rank in the class. (6) All universities and almost all lower schools are government-owned and without exception government-controlled. Finally, (7) all schools within the boundaries of national sovereignty have identical curricula and, hence, quality, irrespective of location. Some of these seven facts will

be further discussed in context with the *structure*, which is outlined in Figure 7.[1]

Figure 7 shows the two flow patterns for the American and the European systems restricted to the technical-oriented education. The American uniflow structure leads through the points A (high school), to B (the baccalaureate degree)

FIGURE 7
Structure and Educational Degrees



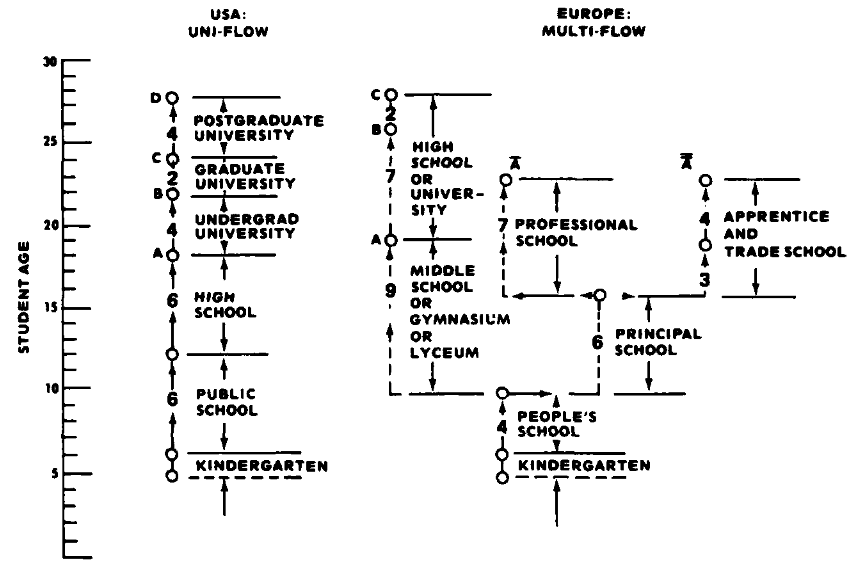
1. The description of the European vs. the American school system is based on my own life-long involvement with education: passive as student, active as teacher, and observing with my own children and friends' children. I myself am the product of Austrian humanistic education; my children went through Austrian, German, French, and American schools—including universities—and I have never given up teaching, either as a vocation or avocation, at M.I.T., DSMC, and V.P.I. and S.U. I have given seminars at N.Y.U., at Columbia, and as a visitor at the Technical University in Vienna. I observed the school systems in Denmark, Sweden, Italy, Switzerland, Great Britain, Brazil, and Japan and, of course, in Germany and Austria, but also have some first-hand insight into Russian education. In developing this article, I reviewed among others, the following material: *Facts about Germany* (Bertelsman Lexikon Verlay, 1979); *Facts about Germany, Press and Information* (Office of the Government of the Federal Republic of Germany, 1972); *Österreichische Bundesblatter (Gesetze, Erlässe)—Ingenieurgesetz, Hochschulbestimmungen, Lehrpläne*—covering the time after WWII; *Informationen Zur Politischen Bildung* (Berlin, Bonn, Luxenburg, and Wien); publications of the French government on French culture and education.

to C (the master's degree) and finally to D (the Ph.D. level). All steps follow in one single line. In contrast, the European school system has a multiflow structure with two splits. The first split, Split-1, leads, on the left side of the diagram, toward the university line, while the right branch continues the mandatory schooling up to Split-2, where the left branch goes into non-university-related engineering schools and the right branch into trade education. The European university line has at Point A an equivalent to an American academic high school plus the freshman year in college. At Point B the *diplom engineer* (professional engineer) is considerably more than the American master's degree; it is approximately an M.S. degree plus all predoctorial examinations. At Point C is the doctor of engineering degree. The two other branches lead toward an engineering (but not *diplom engineer*) degree at $\bar{A}$ and the certification of trade master at $\bar{\bar{A}}$.

In Figure 8, the names of the schools are spelled out and the duration of the school years indicated. Note that the European universities are also designated as *hochschule* in the German-speaking parts of Europe, which is translated as "high schools," meaning schools for higher learning. Today, all high schools have shifted to the designation "university"; this started about 20 years ago in order to correspond with the United States. The different usages of the words "university" and "high school" (*hochschule*) have historical origin. The term "university" once covered the disciplines of philosophy and the humanities, linguistic and historic disciplines, pure, non-applied science of any kind, as well as political sciences, human medicine, law, and theology. The term "high school" has been used for the disciplines of economics, all applied technical sciences, veterinary medicine, and to the academies of art.

Today, all those high schools and academies are called universities; however, their physical and administrative separation is maintained. This is one reason why most European universities are small compared to U.S. universities. The administrations are further simplified by not being in the hotel business (dormatories), in the entertainment business (sports), or in the psychology business (student counseling). All those activities are shifted either to the student self-administration, the welfare departments of the states, or the local business community. This can be done easily in Europe, because all universities are located in the centers of major towns. The universities are concerned with teaching and research. The rector (president of a university) is elected, as a rule, from among the senior professors by the senior professors for 1 year; the deans are elected in the same manner. The senior professors (full professors) are all autonomous and owners of a chair with numerous *docents* (associate professors) and assistants. In the technical-oriented domain, full professors are not promoted through the professional ranks but "called" from the outside based on exceptional ac-

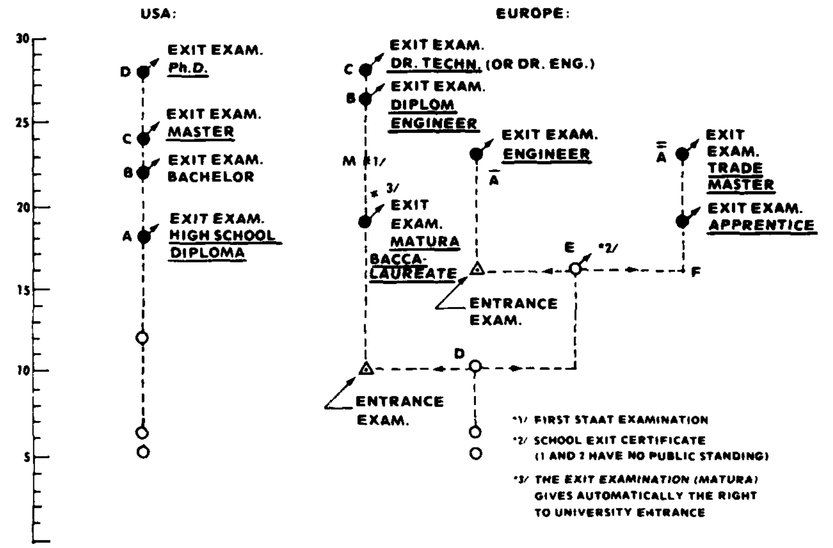
FIGURE 8
School Type and Duration



complishments in industry, science, and research. From the point of view of status, a full professorship is the culmination of a man's career as well as a sinecure for lifetime. Professors and teachers in less-exalted schools share in the public esteem (and job security since they are government employees). Even the school teacher in a small Alpine village is a man of distinction and a ranking member of the community.

In Figure 9, the exit and entrance examinations of the American and the European school systems are compared. The American system has no formal entrance examination comparable to the European system; the closest comparable examination is the college qualification test. In the European system the selection starts with a government-controlled entrance examination at the tender age of 10 at Decision Point D in Figure 9. This entrance examination into the gymnasium (see Figure 9) is a go/no-go decision for an academic-oriented career. A later decision for an engineering career (but not an academic engineer) or a trade career takes place at Point E, and even at Point F the acceptance by a trade master is required. The next most important point in the European academic career is the federal or

FIGURE 9
Degrees and Examinations for Entry and/or Exit

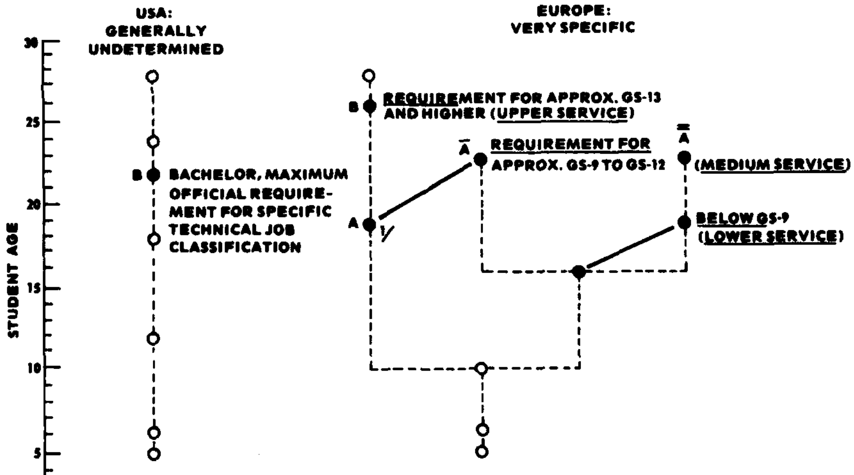


state government-controlled exit examination at the end of the gymnasium at Point A. Passing the exam is independent of the achieved grade and entitles any student to enter any university of *his* choice. No university has the right to reject the student. The matura examination is the only document which counts irrespective of the quality of passing, and all prior grades are irrelevant. "Class standing" is an unknown term. An equivalent to the American bachelor's degree exists at Point M in Figure 9 and is called the First State (federal) Examination. However, this examination is not generally associated with a degree, nor is the examination generally regarded as an acceptable criterion in the industrial or governmental hiring procedure. Only the *diplom engineer* (at Point B) is a credible stopping point. Anything less than this "degree" is just lost time for the dropout and has no accepted standing; either you finish or you don't. The doctoral degree at Point C is considered to be a personal elective and as "private business" where you can work on your dissertation in absentia from the university. No one is expected to submit a technical dissertation until after at least 10 years of working experience. It was only recently that the dissertation "in residence" acquired reluctant acceptance by the professors. Of course, these rules are not cast in concrete. Germany,

for example, recently adopted a quota system for university admission and the results of the matura examination place one high or low on the waiting list for admission.

Figure 10 gives you an approximation of how government looks at the education of an employee with regard to what we call the GS rating. Note, for example, that the matura examination at Point A is the prerequisite for a GS-9 rating, but with less than a university diploma (Point B) one can never proceed above the GS-12 grade. On the other hand, a young university graduate will start automatically in the GS-13 level although his pay might be only a small fraction of a senior GS-12's, following the old European practice that title and status supersede payment.

FIGURE 10
Education and Civil Service Requirement



NOTE: INDUSTRIAL REQUIREMENTS APPROX. IN AGREEMENT WITH GOVERNMENT REQUIREMENTS

√ MANDATORY FOR ENTRANCE INTO OFFICER CAREER

OFFICERS' ACADEMIES ARE OFTEN CONSIDERED AS UNIVERSITY (GRADUATE) EQUIVALENT

FIGURE 11
Quantity Flow for 1,000 Entries
Drop-Out Rate (Δ in Percent)

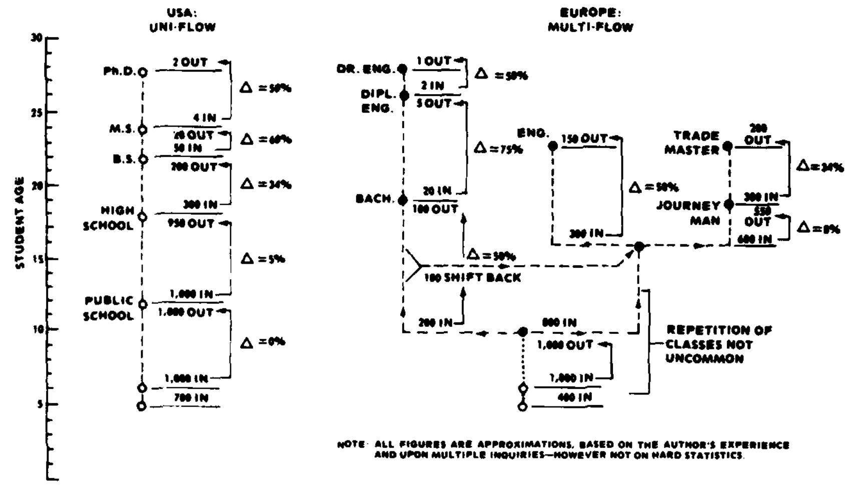


Figure 11 shows the number of students entering (IN) every school segment and the successful passings (OUT) leading to the deltas of percentage in dropouts. One may note the exhorbitant dropout rate—up to 75 percent at the universities—in the European school system, despite the rigorous entrance examinations preceding acceptance to the academic track, or exit examinations at the matura, prior to entering the university.

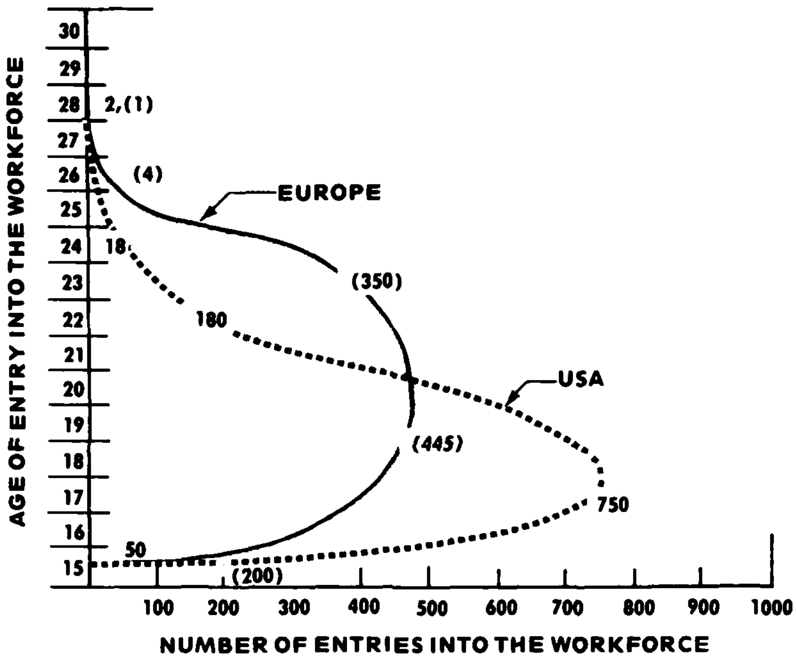
Industrial Implications

The school system determines the entrance levels of the youth into the work force, or labor supply, to industry. We are concerned here only with that part of the labor force that is considered as the future industrial work force. The nonindustrial work forces, even though they are often related to industry, are not considered in this discussion.

The labor supply distribution is shown in Figure 12.[2] It shows a considerable skewing of the American work force toward the bottom of the educational lad-

2. The numerical data in Figures 11 and 12 have only indicative value and should not be taken as scientific statistics. The numerical values are derived from sketchy statistical data of U.N. organizations, and interviews with American and European educators and embassy personnel. Exact data seems not to exist; at least, I was not able to find it.

FIGURE 12
Distribution of Entry into Labor Force



NOTE 1-EACH AREA REPRESENTS 1000 STUDENTS
2-THE NUMBERS ARE THE CALCULATED POINTS
3-NUMBERS IN ( ) ARE EUROPEAN ENTRIES
NUMBERS WITHOUT ( ) ARE AMERICAN ENTRIES

der, while European distribution has a significant skewing toward the middle, but approximately only half the Ph.D.s of the American counterpart. This different skewing may surprise many people, since the notion exists that the American school system produces more technical people than the European system. Unfortunately, this, the American superiority, is correct only with regard to a comparison with the European engineering academic track; here, the American system wins hands down. However, the shown differences in distribution of labor supply are based upon the inclusion of the non-university-related engineering schools and upon the inclusion of the trade masters and the journeymen of the trades

where both have barely or no equivalent in the American school system.

In Europe the non-university engineer is the backbone of all industrial enterprises and the trade masters are the souls of the workshops. The education of these engineers takes approximately 7 years with 25 hours per week in the classroom and approximately 15 hours at the drafting board and in the workshop. The trade master has about 10 hours per week in the classroom and 30 hours on the shop floor. In comparison, the academic engineer (*diplom ingenieur* in the German language) has 7 years of classroom education for 35 hours per week and, (mostly during vacation) averages 5 hours per week in floor training. This slanting of the education enables the engineer from the non-university track to communicate *down* to the workbench and *up* to the development laboratory. (Besides, the separation or early specialization between design engineers and production engineers is almost unknown in Europe; you are both or neither. Independent design offices or the physical separation of the design office from the plant are very rare in Europe).

The implication of the talent supply distribution is sketched in Figure 13.

The talent distribution in the work force permits the European to set up highly flexible manufacturing programs and the efficient production of small lots. His Amer' ın counterpart must be more specialized or subdivide his tasks in order to utilize the less-skilled work force. This in turn leads into large manufacturing units with high specialization and large outputs—exactly the two forms of the industrial picture we find in Europe and the United States. There remains, then, the eternal chicken-and-egg question: Has the structure of the industry developed as it has because of the form of the talent base? Or has the school system responded to the needs of the industry with peculiar forms of education? The truth probably lies in between.

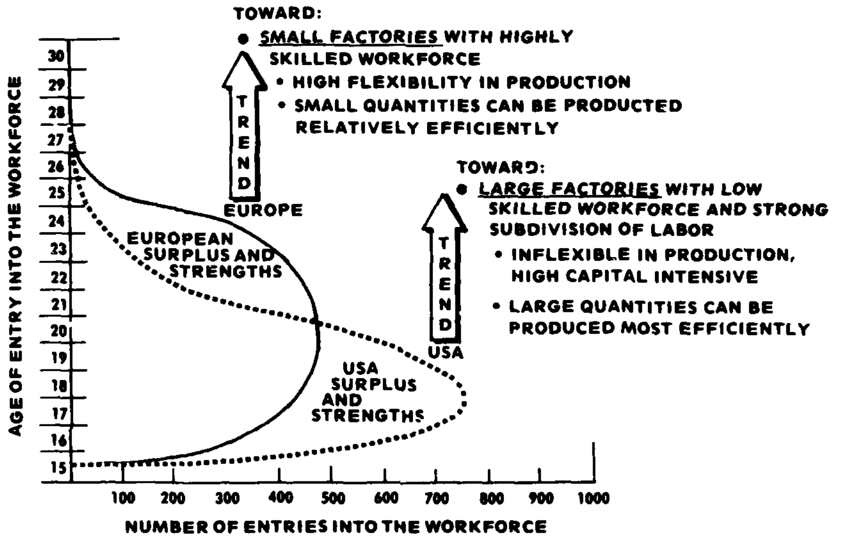
Earlier, I characterized the American system as egalitarian, pragmatic, and competitive, and the European system as elitist, humanistic, and noncompetitive. The justifiction for these designations should be clear from the previous discussion, but let us summarize.

Egalitarian (U.S.): The American school system allows everybody to float in the broad river of the educational blessing. Social promotions dominate up through high school graduation, and any distinct track system is viewed with suspicion.

Elitist (Europe): All schools are practically free of cost, but if you flunk you flunk, and nobody cares about your feelings, your finances, or your father's position.

Pragmatic (U.S.): Schools are a business and you pay for it. On the other hand, in order to promote business, the universities cater to the students' needs and almost any subject can be studied and learned after hours—for a fee. This is an

FIGURE 13
Implication of Labor Supply Distribution



advantage practically unknown in Europe.

Humanistic (Europe): Europe does not necessarily equate learning accomplishments with job selection, and a knowledge of the classics and history is still in high esteem—even for engineers! Specialization is restricted at the universities and emphasis put on fundamental concepts and problem solving (especially in small countries).

Competitive (U.S.): Class standing is often everything inside and outside the university.

Non-competitive (Europe): Class standing is unknown. Grades at the university have internal value with regard to the final examinations requirements, but for the outside, either you are a university graduate or you are not.

The foregoing definitions are subjective—or as I see it. You may, for example, prefer classical for humanistic or non-classical for pragmatic. I am not quibbling with this. What is important for me is to get the ideas across.

Titles

It is often said that Europeans are title conscious. They are. Please, never under any circumstances call Dr. Meier simply Mr. Meier; he might never forgive you. And as long as you can resist, do not call a European by his first name. Most Europeans will feel uncomfortable to be called by, or to call you by, the first name. The first name is mostly used only within the family and among a few (and very few) best friends. Even in public schools, pupils call each other by the family names; so do soldiers in the boot camp and workers in the factory.

Titles, especially academic titles, are for most Europeans the highest incentive—like a million dollars for an American. Academic titles (Dr. or *Dipl. Ing.*) erase differences in the hierarchical standing and open the doors to society. In many places the academic title is considered as a legal prefix to your name. You may lose your right to use this prefix if you are found guilty in court for a felony; while somebody without such a prefix may get 1 year in jail, the academic may get only 1 month—but he looses for a lifetime his right to a job requiring his degree.

These, of course, are subtleties without written rules and regulations. But this is European reality and you, as manager of a defense program in the NATO environment, should be aware of it.

Historically, academic titles are the lowborn's equivalent to nobility. Non-academic titles in government parallel academic titles, and from a taxpayer's point of view, are less costly than a high salary while providing the same motivation. Of course, the Americanization of Europe has blurred this title panorama; however, the concepts still linger on, and much stronger than the superficial observer may believe.

Taxation

Nothing reveals more clearly the true thinking of a nation about the desired social structure th .n the national tax code. In the broadest sense the tax code tells where the money for federal expenses comes from and where it goes. The way a nation levies taxes tells us what that nation, in its totality, considers "just," and the way it spends its income tells us what it considers "valuable." For example, if you find out that in a certain nation the citizens pay taxes progressively *ad valorem* for luxury items and that the federal subsidy for the performing arts is larger than the entire budget for the state department (including all embassies around the world) you may well assume that nation is dominated by an interesting value system. Such a nation does exist. It is Austria, a nation with a tenacious hold on peace and prosperity (*U.S. News and World Report*, May 19, 1980).

Although Europeans have quite a uniform view toward taxation, and in particular toward the definition of profit, their opinion is not codified in a general "European tax theory." They do it purely pragmatically. Hence, I have been forced to construct a European tax theory in order to summarize and explain succinctly what happens in the "old countries." This European tax theory—a tax model if you wish—also includes the almost ancient European concept of front-subsidies and end-taxes. Germany, Austria, France—everybody—practices it, and still the literature is mute about a comprehensive theory. It almost seems as if all these practices have developed in a long trial-and-error period from the end of World War I until today. The tax system simply works and satisfies in a simple, pragmatic way, the European search for a balance between a free economy and a socialistic protection of the populace.

The European attitude toward "right and just" taxation is non-ideological and purely pragmatic. The pragmatism has evolved from the lessons of WWII—the complete collapse of the European economy. Giants like de Gaulle and Adenauer laid the moral foundations for nationwide cooperation and social partnership among government, corporations, and unions. The values of classical philosophy, humanistics, and Christianity were proclaimed the guiding lights for Social Democrats and Christian Socialists alike; the difference being that the first have been searching for a socialism from the bottom up, the latter from the top down. The historical succcesses by Monet and Erhard, the two most prominent leaders of the French and German economies after WWII, have given an edge to the "top down" approach. This tends towards a free economy, while broad economic planning—without micromanagement and without paranoid feelings toward business—has been accepted widely. More simply expressed, the European governments consider private business as a source of employment and are willing to give a business anything and everything that is necessary to make it flourish: tax incentives, protection, and the right to make decisions with a minimum of legislative constraints. In return for those incentives the governments expect private industry to carry a considerable amount of social burdens as a *quid pro quo*. To explain the incentives, I have selected the subject of profit; to explain the social burden, I will use the subject of the non-fireable labor force.

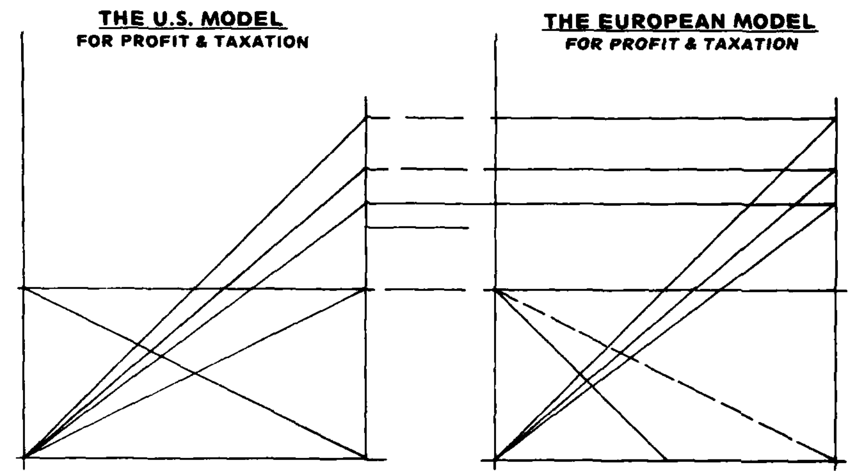
Profit

To a simpleton like me, profit is the difference between all my income and all my expenses. To the polished economist, it may be the difference between price and cost; but to the institutionalist it is the difference between price and "allowable" cost. "Allowable," however, is a federal rubber band of ill-defined length and is quite differently viewed in Europe and the United States. For

Americans, profit is associated with morality and price theory; for the Europeans it is associated with pragmatic cost theory only. Hence, the American economic literature is dominated by contributions to the price theory, while the European literature is dominated by contributions to the cost theory. Moralists are interested in how capital or earning power is acquired; pragmatists in how it is preserved, but not to whom it belongs. This may appear to be subtle differences or even a game in semantics; in reality it is not. The differences are substantial in their implications.

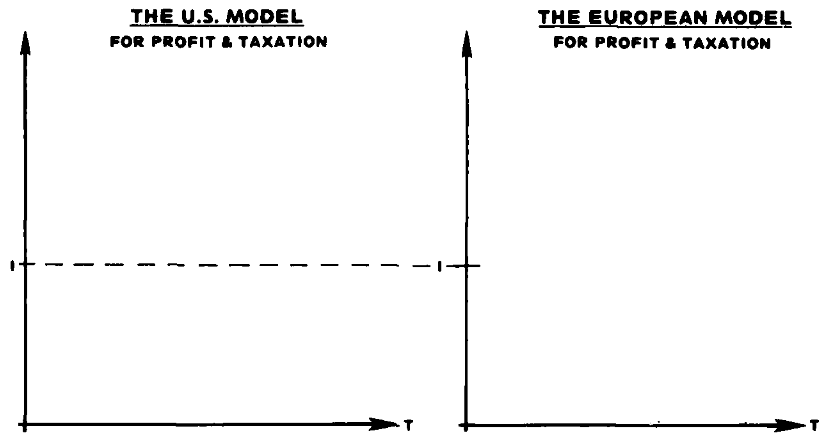
In order to explain the differences between American and European views toward profit, let us put two graphical models of those different viewpoints side by side; the American model on the left side, European model on the right side. Here we will begin with a complete shadow model (Figure 14). Thereafter we will highlight within the shadow model the specific points of discussion.

FIGURE 14
The Shadow Model for Profit and Taxation



In both models, the horizontal axis represents time T and the vertical axis the U.S. dollar amount $. Also an identical assumed point in both cases is the investment I. With this, the picture of profit begins to develop (Figure 15).

FIGURE 15
Time - Investment



Since we have invested the amount I (let's say for a production machine), we must depreciate the investment I over the technical lifetime T.[3] Here, then, is the first difference (Figure 16).

Quite frequently in Europe, the government encourages use of the shortest possible and affordable depreciation allowance in order to foster a specific segment of the industry. For example, at one time, when shipyards were down and ship operations booming, certain European governments (Sweden, Norway, and West Germany) induced new ship orders by permitting a reduced depreciation time for ships of 3 years against the more conventional 15 or 20 years.

Without question, it makes a substantial difference whether the T_L is a function of the IRS or of the industry itself (negotiated through the trade association); however, for the sake of the argument, let us assume that we use for the U.S. model and the European model the same technical lifetime and, of course, the same initial investment I (Figure 17). We also assume for both cases linear depreciation toward zero, disregarding any residual value at T_L.

Now, keep in mind that the purpose of the depreciation (allowance) is to offer

3. Since I am only concerned with the conceptual differences between Europe and the United States, I accepted a linear model for depreciation and capital accumulation and disregarded the residual value at the end of the lifetime.

FIGURE 16
Technical Lifetime

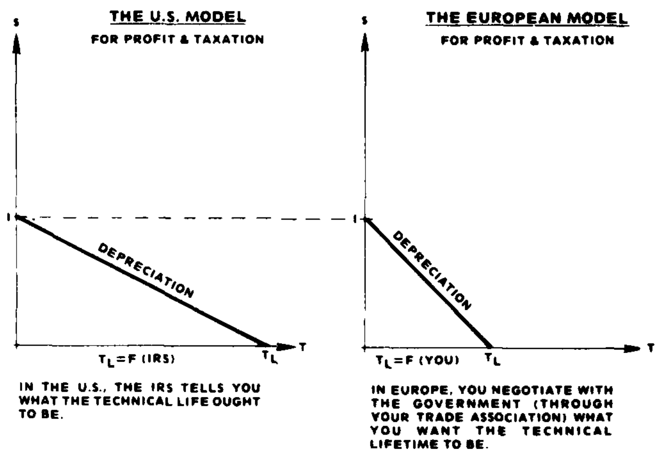
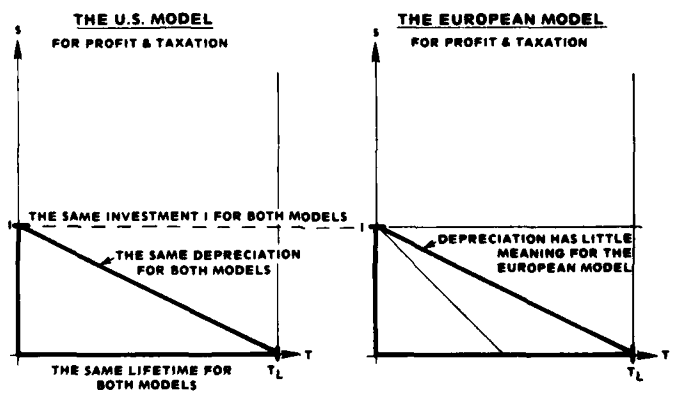
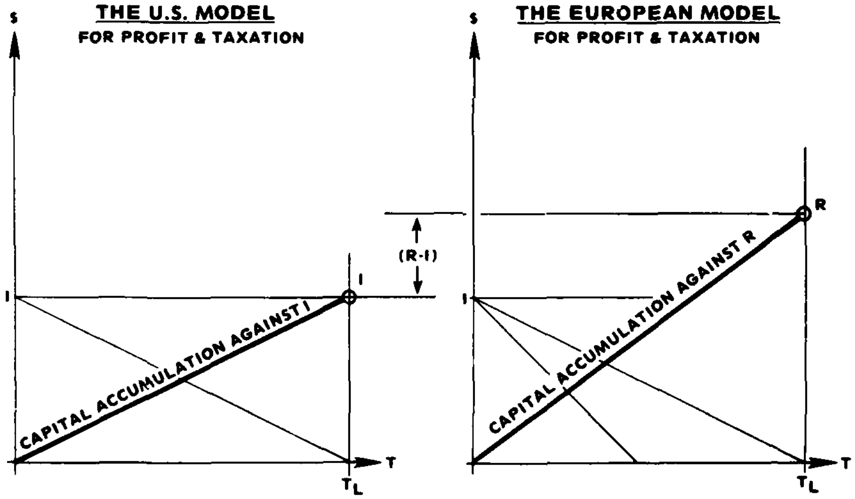


FIGURE 17
Basic Assumptions



the opportunity to recover the investment and/or to accumulate sufficient money to replace present equipment after the time T with new equipment. Of course, the new equipment might be better than the old, but to keep the argument simple, let us now assume that we replace equipment on a one-to-one mapping. This means, in the most primitive and the most stable of all worlds, the operator wants to replace expended capabilities, representing "earning power," with identical new capabilities or "new earning power." Hence, two different points of view are emerging: (1) The investor wants his money back (plus interest); and (2) the operator wants his production capability rejuvenated. The first point of view is American, the latter is European. The result is shown in the next sketch (Figure 18).

FIGURE 18
Capital Accumulation



THE AMERICAN CAN ONLY ACCUMULATE CAPITAL TOWARD THE INVESTMENT I.

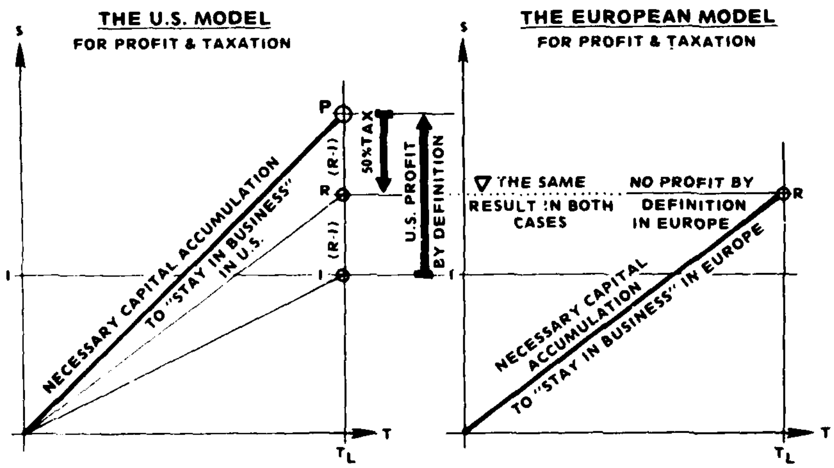
THE EUROPEAN CAN FREELY ACCUMULATE CAPITAL TOWARD THE REPLACEMENT VALUE R.

This does not mean that R is different for the American counterpart, (or at least let us assume that it is the same) and the American is burdened "by law" with an initial deficit of R minus I, written as (R-I), which he has to cover out of profit. In order to do this, he must accumulate capital against I+2(R-I) so he can

pay 50 percent tax (R-I) on his "profit" (Figure 19).

But of course, no one can expect the European businessman to work without profit. Let us assume, then, that he puts a profit margin on his product. This gives him the same factor price (as related to capital) as his American competitor. Now the European picture changes (Figure 20).

FIGURE 19
Replacement and Profit



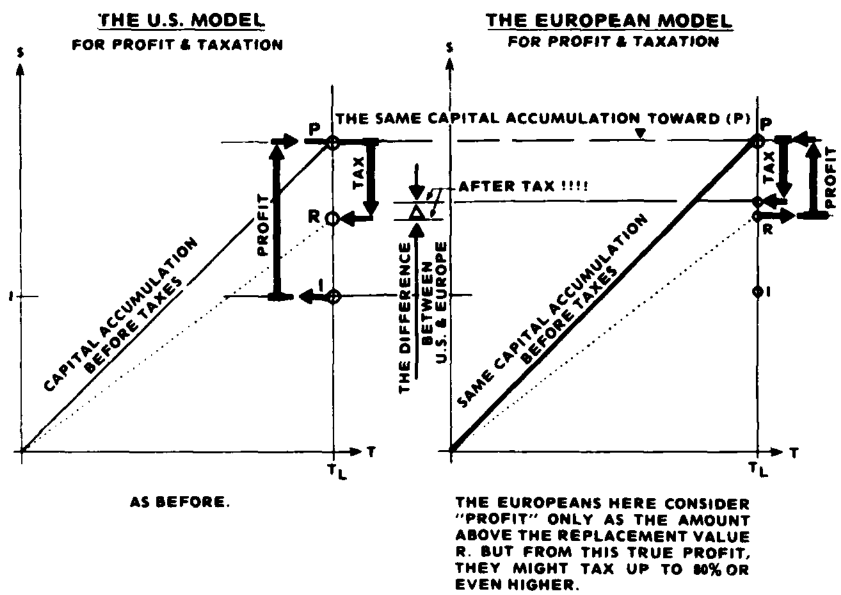
THE AMERICAN—IF HE WANTS TO HAVE ENOUGH MONEY IN HIS POCKET, MUST ACCUMULATE MONEY TOWARDS THE VALUE P IN ORDER TO HAVE ENOUGH MONEY TO COVER R—AFTER PAYING *ABOUT 50% TAXES. THE AMERICAN* PROFIT IS BY DEFINITION 2X(R-I).

THE EUROPEAN IS ABLE TO ACCUMULATE MONEY TAX FREE TOWARDS R WITHOUT "PROFIT" AND ENDS UP AS GOOD AS HIS AMERICAN COMPETITOR WITH A "PAPER PROFIT" OF 2X(R-I).

Even though the European might face an almost punitive tax, in the end he is still better off by the amount delta (Δ) than his American counterpart.

In times when excessive growth was considered mandatory, many European governments declared any profit to be tax free as long as the true profit was reinvested in the *company of origin* within the same year. This prevented profit migration into diversifications, and was essentially the basis for Ludwig Erhard's German *Wirtschafswunder*, the economic miracle of the German economy after WWII. I remember, for example, shipping lines ordering new ships (and committing down payments) at the end of the fiscal year—with one or two pages of

FIGURE 20
Profit on Both Sides



specifications—while we in the shipyard ordered new equipment from equipment brokerage houses without really knowing for sure if we wanted a lathe or a crane or something else. The result was that everybody invested frantically, and often unwisely, and nobody had a "profit." But each company rebuilt with amazing speed. In addition, Germany had the so-called "7 D tax provision": Industries were selected based on national importance (shipyards, steel mills, etc.) and *any* investment in those companies was tax free with no questions asked.

Until now, the different definitions of "profit" might be not too significant. Currently, some efforts are being made in the United States to study the effects of depreciation factor against replacement costs and appropriate accounting standards. Fundamental differences in the definition of profit appear, however, when we superimpose "competition" on the comparison of the European and American tax system. So let us consider the competitive scenario of Figure 21.

Which means, because of the American definition of profit, the American company in reality loses its earning power and lives on capital—until it dies a

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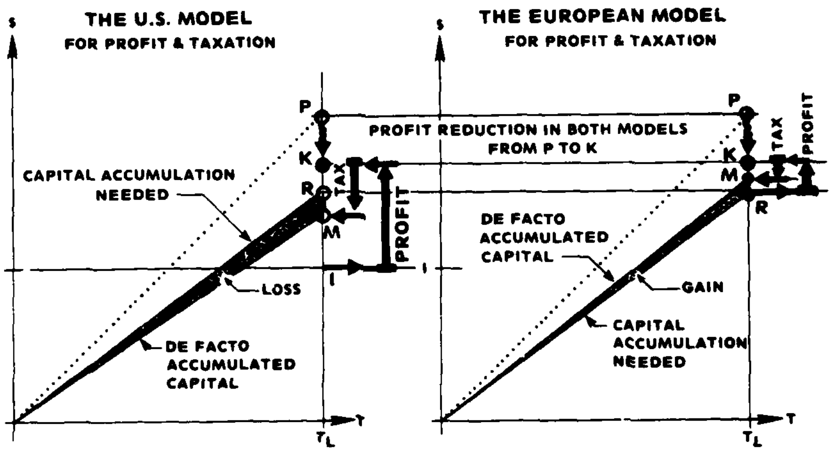
FIGURE 21
Competitive Scenario



THE EUROPEAN COMPANY STARTS OUT ON THE PARITY LINE WITH THE AMERICAN COMPANY, POINTS P. IN ORDER TO BE COMPETITIVE, THE EUROPEAN DECIDES TO REDUCE HIS PROFIT DOWN TO THE POINT K. AND

THE AMERICAN COMPANY DECIDES TO ACCEPT THE SAME PROFIT REDUCTION DOWNWARD TO THE POINT K AND THE REMAINING PROFIT (BEFORE TAXES) IS REDUCED FROM (P-I) DOWN TO (K-I). FROM THIS "PROFIT" THE AMERICAN HAS TO PAY 50% TAXES AND HE ENDS UP AT POINT M, BELOW R. .... WHILE HIS EUROPEAN COUNTERPART, EVEN AFTER PAYING 80% TAXES, STILL ENDS UP AT HIS POINT M, ABOVE R.

pleasant but predictable death. The American can never officially acquire the capital to preserve his earning power in a competitive mode. This is in essence the problem of Chrysler and the American steel industry, and other industries will follow. The most extreme case would exist if the European competition is willing to forego any profit and consider R as the capital factor of production. If in this case the American counterpart decides to reduce his profit from 2 × (R-I) down to 1 × (R-1), he has lost *de facto* (R-I)/2 of his earning power since this part goes toward taxes.

The different approaches to profit between the American and the European are of historical origin. The American restrictive profit definition has developed in times of (a) high profits, (b) monetary stability, and (c) a permanent growth. The European profit definition has evolved under (a) often rampant inflation, and (b) restricted markets. But there is also another, seldom-considered, fundamental driving force behind the different profit definitions: Financing is done in the United States primarily through the public stock market, while in Europe financing is accomplished through banks which, quite frequently, even control the majority of a company stock, either through direct ownership or through the proxi-position for the banks' clients.

Before closing this section, let me return to the term of earning power, which I used previously. Earning power is represented by the tools with which one makes things, or more generally, how one earns his keep. If somebody, for example, buys a 10-ton truck with cash in order to earn his living as a trucker, then his truck is his earning power. But the trucker can only preserve his earning power if at any time during the truck's life, the following condition is met: Resale value of the truck, plus accumulated capital reserves toward buying a new truck equal the replacement cost of the truck. If taxes, financial mismanagement, or competitive pressures do not permit him to accumulate capital to meet the above condition, the trucker has lost part of his earning power.

Labor Stability

Now, since we have discussed the incentives for the European entrepreneur, let us now discuss some of his burden—his obligation to stabilize the labor force. In itself, this has nothing to do with taxes; however, in its impact it is so strongly related to taxes that we may as well bring up the subject. Besides, the obligation to stabilize the labor force is almost nowhere in Europe clearly spelled out as a legal obligation; it is rather a *de facto* obligation enforced by union contracts pertaining to severance pay, and similar institutionalized elements. Present efforts in the U.S. Congress to introduce job protection laws in cases of factory closings or relocations bear a vague similarity to the European situation. So, let us simply state that it is difficult in Europe to fire people based on "proportional cost factors." On the other hand, because of full employment, it is difficult to hire from a fundamentally non-mobile workers' pool. The fact is, the European manufacturer is working with a *constant* work force, while his American counterpart is working with a *variable* work force. In professional economic terms:

—The European manufacturer works with fixed cost for capital $(FC)_C$ and fixed cost for labor $(FC)_L$, while

—The American manufacturer works with fixed cost for capital $(FC)_C$ and proportioned cost for labor $(PC)_L$.

These are two elements we are using to develop a simplified comparative model, again starting with a shadow model (Figure 22).

As the first step, we block out premises for our comparison (Figure 23).

Now, let us assume that both systems are played against the same market and

FIGURE 22
Shadow Model for Labor

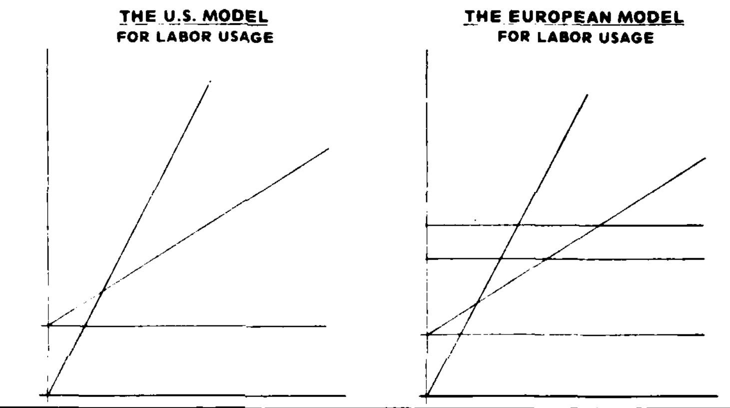
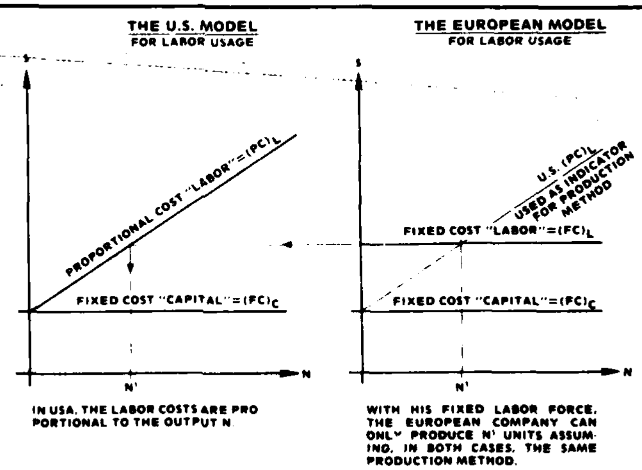


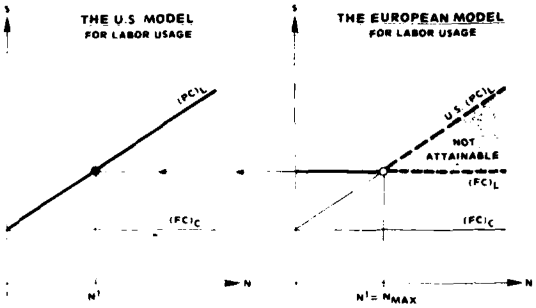
FIGURE 23
Premises for Comparison



against the same market potential. Let us also assume that both systems are presently working above the break-even point (B.E.P.). If this is the case, then the European company is in a most *unfavorable* position (Figure 24).

We mentioned already the "market." Now let us see how the market shows up in our shadow model (Figure 25).

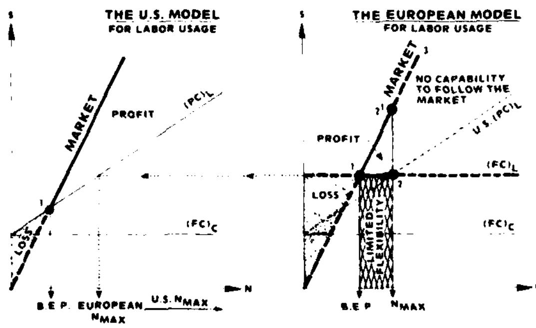
FIGURE 24
European Impediments



THE AMERICAN CAN RESPOND TO A MARKET UP TO THE FULL UTILIZATION OF HIS EQUIPMENT EVEN WITH THREE SHIFT WORK

THE EUROPEAN CAN ONLY RESPOND UP TO N_{MAX} WITH A GIVEN WORK FORCE AND IF THIS WORK FORCE IS ONLY A ONE SHIFT WORK FORCE IT IS JUST TOO BAD. EVEN OVERTIME IS OFTEN RESTRICTED.

FIGURE 25
Market and Labor Force



THE B.E.P.—THE CROSSOVER BETWEEN "COST" AND "MARKET" IS PRETTY FAR TO THE LEFT (B.E.P. = BREAK-EVEN POINT)

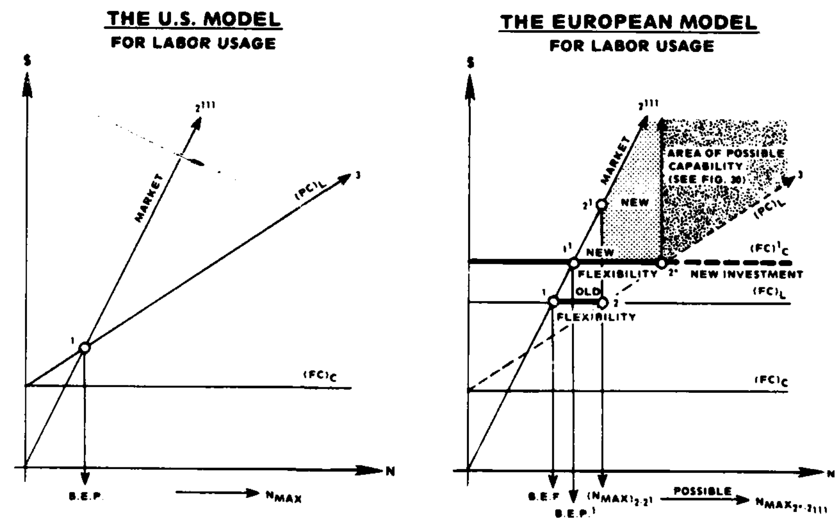
THE B.E.P IS MUCH FURTHER TO THE RIGHT THAN FOR THE AMERICAN COMPANY AND THE COMPANY'S FLEXIBILITY TO RESPOND TO THE MARKET IS ALMOST NON EXISTENT. IT IS REDUCED TO THE SMALL DIFFERENCE BETWEEN POINT 1 AND 2 OR AS BETWEEN B.E.P. AND N_{MAX}

American managers would consider the European straightjacket of a "constant labor force" an unbearable. Not so the Europeans. Since they have to live with the labor-constant, they are putting all their effort into better equipment in order to produce more and more with the same work force. In other words, they invest and invest, and the investment is fostered by the tax structure. Result: The European (and the Japanese) productivity of the constant work force increases with each new investment. Expressed in other terms, the European company puts a second layer of capital-dependent fixed cost $(FC)_C$ above the fixed labor cost $(FC)_L$ in order to satisfy the market demand, as shown in Figure 26.

The actual cost-performance relationships for the European model and also for the American model are much more complicated than shown in this simplified form because of the non-linear relationship between investment and capability.

FIGURE 26

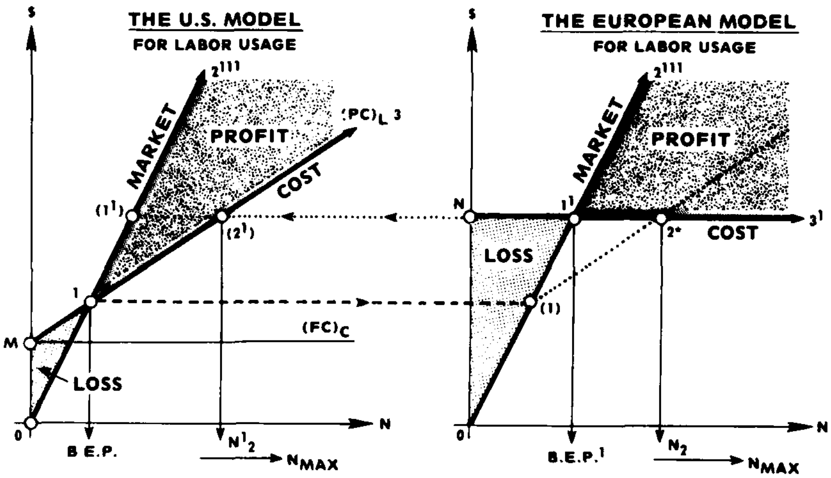
Response to the Market



THE AMERICAN COMPANY WITH ITS VARIABLE (FLEXIBLE) LABOR FORCE CAN FOLLOW THE MARKET IN THE AREA (1-2^{111}-3) BY HIRING AND FIRING WORKERS ACCORDING TO THE MARKET'S DEMAND. N IS ONLY DETERMINED BY THE CAPABILITY OF THE FIXED ASSETS.

THE EUROPEAN COMPANY WITH ITS FIXED (INFLEXIBLE) LABOR FORCE CAN FOLLOW THE MARKET ONLY IN THE AREA (1-2-2^1). IN ORDER TO UTILIZE THE AVAILABLE MARKET, THE EUROPEAN ADDS A NEW LAYER OF FIXED (INVESTMENT) COST $(FC)^1_C$. WITH THIS, HE CAN NOW FOLLOW THE MARKET AREA (2^{111}-2^*-3).

FIGURE 27
Behavior Pattern



THE AMERICAN MODEL SHOWS A RELATIVELY SMALL LOSS AREA (0-M-1) AND A MODERATE PROFIT AREA (2^{111}-1-3).

THE EUROPEAN MODEL SHOWS A RELATIVELY LARGE LOSS AREA (0-N-1^1) AND AN EVEN LARGER PROFIT AREA (2^{111}-1^1-3^1).

However, our simplified model should suffice to explain the principles of the problem, especially since we are more concerned with the behavior pattern that results from fixed vs. the variable labor force than with the way the actual results are calculated. The behavioral results are sketched in Figure 27.

Finally, if we compare the U.S. model and the European model, the results are as shown in Figure 28.

Until now, we have, in the interest of simplicity, assumed that the elevation of the proportioned labor force is independent from the investment level. In reality, the elevation gets smaller and smaller with increased investment levels, as sketched in three stages (Figure 29).

If we introduce this refinement to our comparative model, the disadvantage of the constant labor force will even turn into a very pronounced advantage, as sketched in the final figure of this section (Figure 30).

From a rigorous academic point of view, much more would have to be said about the two cost models. First, neither linearity nor continuity represents reality. Second, the relationship between investment and productivity would need

FIGURE 28
Comparison

(1) BREAK-EVEN POINT BEP (USA) LOWER THAN BEP (EUROPE)

(2) U.S. LOSS POTENTIAL (0-M-1) IS SMALLER THAN EUROPEAN LOSS POTENTIAL (0-N-1^1)

(3) AREA (1-1^1-S) IS PROFIT FOR U.S. AND LOSS FOR EUROPE

(4) U.S. PROFIT SUPERIORITY IN AREA (1^1-S-2*)

(5) EUROPE PROFIT INFERIORITY IN AREA (1^1-2*-P)

(6) PROFIT IN AREA (2*-3-3^1) ONLY POSSIBLE FOR EUROPE

(7) U.S. PROFIT INFERIORITY IN AREA (2*-3^1-3)

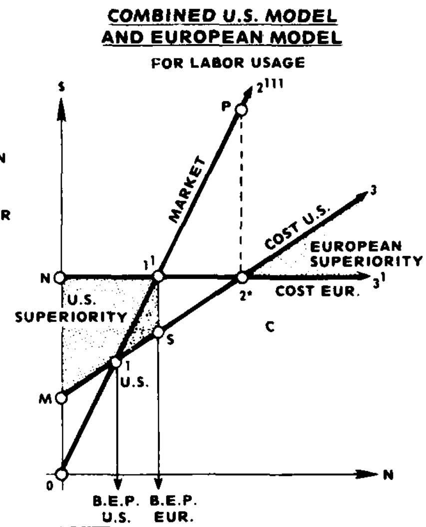
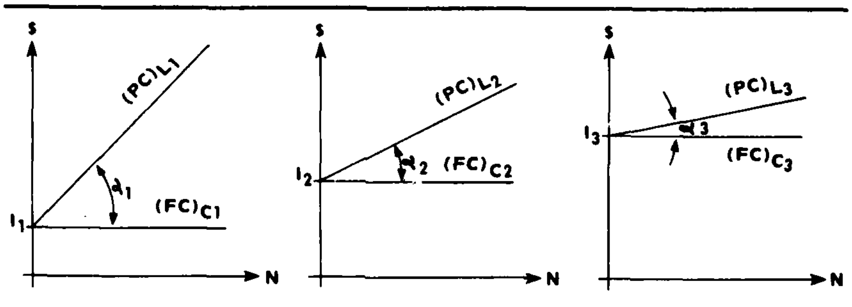


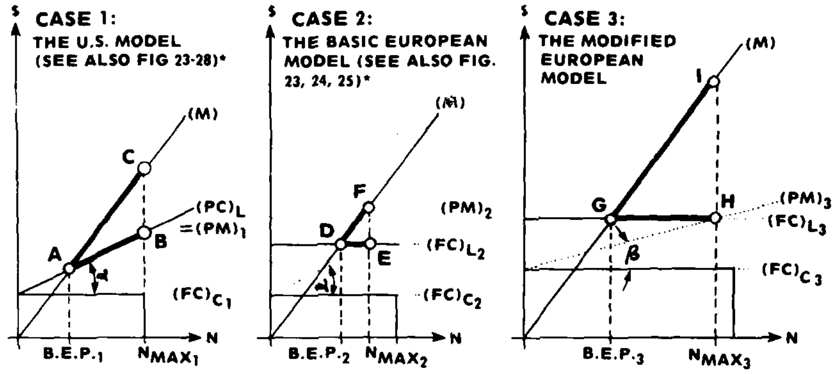
FIGURE 29
Labor Elevation (α_i) and Investment (I_i)



($I_1 < I_2 < I_3$) AND ($\alpha_1 > \alpha_2 > \alpha_3$)

FIGURE 30

Constant Labor Force with Declining Elevation (A,B)



*THE POINT IDENTIFICATION IS NOT NECESSARILY THE SAME AS BEFORE.

TO CASE NO. 1
THE U.S. MANUFACTURER WORKS WITH A FIXED COST FOR CAPITAL $(FC)_C$ AND WITH A PROPORTIONAL COST FOR LABOR $(PC)_L$. HIS $(PC)_L$ IS IDENTICAL TO HIS PRODUCTION METHOD (PM). FOR A GIVEN MARKET (M) COST AND EARNING WILL CROSS AT POINT A, RESULTING IN THE BREAK-EVEN POINT $(B.E.P._1)$. HIS MAXIMUM PRODUCTION QUANTITY (N_{MAX_1}) IS GIVEN BY HIS FACILITIES. HE CAN FOLLOW THE MARKET (M) FOR A PROFIT FROM POINT A TO POINT C, WHILE HIS COSTS MOVE FROM POINT A TO POINT B.

TO CASE NO. 2
THE EUROPEAN MANUFACTURER WORKS WITH THE SAME FIXED COST FOR CAPITAL $(FC)_C$ AS THE U.S. MANUFACTURER AND WITH A FIXED COST FOR LABOR $(FC)_L$. HIS $(FC)_L$ ARE IDENTICAL TO THE PRODUCTION METHOD (PM) ONLY AT POINT E. (IT IS ASSUMED THAT BOTH THE EUROPEAN AND THE AMERICAN MANUFACTURER HAVE THE SAME ELEVATION FOR THE PRODUCTION METHOD.) HIS MAXIMUM PRODUCTION QUANTITY (N_{MAX}) IS GIVEN BY THE SELECTED AND CONSTANT LABOR FORCE. HE CAN FOLLOW THE MARKET (M) FROM POINT D TO POINT F, WHILE HIS COST REMAINS CONSTANT BETWEEN POINT D AND POINT E. HIS BREAK-EVEN POINT $(B.E.P._2)$ IS HIGHER THAN FOR THE U.S. MANUFACTURER AND HIS (N_{MAX_2}) LOWER THAN FOR THE U.S. MANUFACTURER.

TO CASE NO. 3
THE EUROPEAN MANUFACTURER CHANGES HIS PRODUCTION METHODS (PM) AND WORKS (A) WITH A HIGHER FIXED COST FOR CAPITAL $(FC)_C$ AND (B) WITH A LOWER ELEVATION β FOR HIS IMPROVED PRODUCTION METHOD. HIS NEW MAXIMUM PRODUCTION QUANTITY N_{MAX} IS AGAIN GIVEN BY THE SELECTED AND CONSTANT LABOR FORCE. HIS NEW FIXED COST FOR LABOR $(FC)_L$ IS IDENTICAL TO THE NEW PRODUCTION METHOD (PM) ONLY AT POINT H. HIS BREAK-EVEN POINT $(B.E.P._3)$ IS HIGHER THAN IN CASE NO. 1 AND CASE NO. 2 BUT SO IS HIS MAXIMUM OUTPUT POTENTIAL. HE CAN FOLLOW THE MARKET (M) FROM POINT G TO POINT I, WHILE HIS COST REMAINS CONSTANT FROM POINT G TO POINT H. THE SAME MARKET IS ASSUMED IN ALL THREE CASES.

much more rigorous treatment, and so would the relationship between investment and proportioned labor force. To discuss all this, however, would take quite a few lectures. Hence, I suggest that you accept the linear and simplified model; it should suffice to illustrate the differences between the American and European concepts.

Front Subsidy-End Taxes

One of the most interesting European concepts is the combination of front subsidy with end taxes. This combination provides the European governments with the most simple fiscal control tool: (1) It makes it possible to bring whatever is considered as essential goods to the market at low prices; (2) it reduces the risk volume of the business operation, and therefore reduces the multiplier effect of base inflators; and (3) it allows compliance with social judgment as to where the almost punitively heavy taxation will be located. Of course, the system presupposes that subsidies for railroads, the postal operation, and staple foods, as well as school and health services, and to a large degree housing, are not considered as absurd. However, Europeans have been accustomed to subsidizing those operations ever since the time of the Empress Maria Theresa of Austria-Hungary and of King Frederick the Great of Prussia, two historical figures who have never been blamed for socialistic emotions in the Marxian sense.

The concept of front subsidy and end taxes can easily be explained by a simple example: First we will discuss the price formation of a product from the factory to the distributor and the retailer. Second, we will discuss what happens if a factor of production changes at the factory level without subsidy, and third we will discuss the same change with front subsidy and end taxes.[4] All three cases are summarized in Table I.

Please note that the markup as shown in the table is not profit, it only includes a hoped-for profit. The markup covers, or should cover, the wholesalers' and the retailers' expenses. Depending upon the product, the cost chain from the factory, first to the wholesaler and then to the retailer, may be as low as 100 percent to 105 percent to 115 percent or as high as 100 percent to 200 percent to 400 percent. It depends upon the product and the market structure. Therefore, any cost increase ex factory increases as a *constant percentage* through the chain. In the example in the table, the cost increase has multiplied by a factor of three on the way from the

4. Europeans have a strong inclination to use end-item or end-customer taxes in the form of sales taxes and luxury taxes with progressive tax rates with the value of the goods sold. For example, a small car may have a lower sales tax rate than a big, luxury car. These taxes have a similarity to the *ad valorem* taxes imposed as customs duties in many South American ports.

Another point: License plate fees and car insurance are in Europe a function of car size and horsepower. Gasoline tax is about one to two dollars per gallon—but no single European government would dare tell its car makers what the average fuel consumption of their cars has to be. You see, one can skin a cat in many different ways. Reference material for the section on taxes includes: *What Austria Offers the Investor*—(an Austrian government publication); *Summary of French Tax System*—(a French government publication); Konrad Mellerowicz: *Kosten und Kostenrechnung, Vol. I, II and III* (Walter de Gruyter and Co.); *Informationen Zur Politischen Bil ung* (Berlin, Bonn, Luxenburg, and Wien).

factory to the consumer, and the final price changed from 300 percent to 330 percent.

In the case of front subsidy, the *amount* of the cost increase through the chain has been kept constant, and the combination of front subsidy with end taxes prevented the multiplication of the factor increase through the chain. If this simple principle is applied throughout the economy, an average inflation factor of 10 percent can be reduced to an average inflation factor of 3⅓ percent. Of course, for this principle to be executed, the government must have a very strong fiscal authority that can respond expeditiously with tax changes.

TABLE I
Front Subsidy - End Taxes

	FIRST CASE: PRICE FORMULATION	SECOND CASE: NO SUBSIDY	THIRD CASE: WITH SUBSIDY
EX FACTORY	LET'S ASSUME A FACTORY SELLS A SPECIFIC GOOD TO THE WHOLESALER WITH A PRICE EX FACTORY OF $100	NOW LET'S ASSUME ONE FACTOR OF PRODUCTION HAS A COST INCREASE AND ASSUME THIS COST INCREASE (I.E., ENERGY) AMOUNTS TO 10% OF THE ORIGINAL 100% EX FACTORY PRICE. HENCE THE NEW PRICE WILL BE $100 + $10	LET'S ASSUME ON THE FACTORY LEVEL THE GOVERNMENT STEPS IN AND DECIDES TO SUBSIDIZE THE 10% COST INCREASE. (SUBSIDY $10) HENCE THE BUSINESS RISK HAS NOT CHANGED FOR THE FACTORY AND THE PRODUCT IS OFFERED TO THE WHOLESALER AT A PRICE OF $100
EX WHOLESALER	THE PRICE EX FACTORY IS FOR THE WHOLESALER THE FIRST COST ITEM. NOW HE HAS TO TRANSPORT, STORE, ETC., THE PRODUCT AND HE CAN ONLY GUESS HOW MUCH CAPITAL IT WILL BLOCK, HOW LONG WILL IT BE IN HIS WAREHOUSE, ETC. HE ONLY CAN GUESS WHAT HIS ALLOCATION OF HIS OPERATING COST MIGHT BE AND IN THE END HE ALSO WOULD LIKE TO MAKE A PROFIT. HENCE THEY PUT A MARK UP ON THE PRODUCT WHICH IS ESSENTIALLY AN EXPERIENCE FIGURE IN EACH TRADE. FOR THE SAKE OF ARGUMENT, HE SELLS THE PRODUCT AT A PRICE OF $150	THIS INCREASES THE RISK AND THE COST TO DO BUSINESS ON THE WHOLESALER LEVEL AND HENCE HIS COST WILL BE $150 + $15	NOW, SINCE NOTHING HAS CHANGED FOR THE WHOLESALER, HIS PRICE TO THE RETAILER WILL ALSO REMAIN AS BEFORE WITH $150
EX RETAILER	THE RETAILER HAS SIMILAR PROBLEMS AS THE WHOLESALER, ONLY ON A DIFFERENT SCALE: HE AGAIN ADDS A MARK-UP* AND TRIES TO SELL THE UNIT FOR A PRICE OF $300	ACCORDINGLY ON THE RETAIL LEVEL $300 + $30	AND THE RETAILER CAN SELL HIS GOODS TO THE CUSTOMER AGAIN WITH $300 BUT BEFORE THE CUSTOMER CAN TAKE HIS GOODS HOME, THE GOVERNMENT STEPS IN A SECOND TIME AND WANTS ITS MONEY BACK IN THE FORM OF END TAX $10
END COST TO CUSTOMER	$300	$330	$310
RESULT	N/A	PERCENT OF CHANGE IS CONSTANT	AMOUNT OF CHANGE IS CONSTANT

*THIS MARK-UP IS OFTEN CALLED THE KEYSTONE MARK UP, A TERM ORIGINATED IN THE JEWELRY BUSINESS.

This simple example illustrates the European approach—which can be found in slightly modified form in the value-added tax, as practiced almost all over Europe. It also shows that subsidies do not have to be a "welfare action," but rather can be a most powerful tool of economic control.

Risk and Capital Cost

To round out the description of the European attitude toward "business," their view toward risk and capital cost might be used for illustration.

Risk. The German tax law, and others in similar fashion, accepts the risk of doing business as a cost item in bookkeeping. There it is permitted to call 1 percent to 1½ percent of the total business, but not more than 3 percent to 4½ percent of the investment, as risk-cost factor. The figures have changed slightly (within the indicated boundaries) over the last 30 years, but the principle has not. In practice, this means that if a company does about $400,000 of business a year and has a book investment of about $100,000, it is entitled to claim roughly $4,000 as cost of risk in its books, and cost is, of course, tax free. This is not a large amount, but every little bit helps. The idea is that doing business is naturally associated with risk, and at least a part of this risk shall not be associated with profit. This means the tax structure accepts a skewing of the risk distribution, although small, in favor of the entrepreneur.

Capital Cost. Another, even more important, cost item legitimately permitted in bookkeeping is the cost of capital. And this is the point: It does not matter if the capital used in the operation (for any reason whatsoever) is (a) borrowed from a bank or (b) the company's own capital. In both cases, the going bank rate for capital is a legitimate cost item. For example, a company that needs a $100,000 investment can either borrow the money from a bank and pay, say, $10,000 interest, or the company can take the money from its own reserves and claim the $10,000 cost for using (or borrowing) its own money.

The idea of encouraging the company to use its own money instead of borrowing is even extended into purpose-saving; for example, saving to buy a house. In this case, one can make a contract with a bank to save every month so many dollars for a down payment on a house (25 percent to 35 percent). The savings are tax free, and so is the interest on the savings, which might be as high as 12 percent. As soon as the down payment is accumulated, a loan for the balance can be obtained for less than 3 percent over 45 years (in Austria).[5] Of course, if one takes one's money out in order to use it for something other than the contracted purpose, one might lose one's shirt on taxes. ||

(This concludes Part I. See "European Overview Part II: Comparative Investment Patterns" in our next issue.)

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5. Data from the bimonthly newsletter of the Austrian-American Society, Washington, D.C.

45 Can We Afford the DOD Acquisition Improvement Actions?

Colonel G. Dana Brabson, USAF

As we study the 32 DOD acquisition improvement actions precipitated by Deputy Secretary of Defense Frank C. Carlucci's landmark memoranda dated 30 April 1981 and 27 July 1981 [see "Department of Defense Acquisition Improvement Program," *Concepts*, Autumn 1981], we become painfully aware that 13 of the actions require money up-front. It is readily admitted by officials at all levels that, even with the currently projected FY 82 DOD budget, there is no way that all the *implied* fiscal requirements of these 13 actions can be met.

The situation appears even more gloomy as we examine the U.S. economic situation—large federal deficits, lagging productivity, indications of recession, etc. Moreover, if history repeats itself, the FY 83 DOD budget will be characterized by a *decrease* in real buying power.[1] There are already signs that FY 83 will be a difficult year for DOD. The following extract of an article in *The Washington Post* is illustrative:

> Backed by both Democratic and Republican committee members, Roth [Sen. William V. Roth (R-Del.)] warned that what Sen. Warner Rudman (R-N.H.) termed the "very fragile" public support for large defense spending could be imperiled " by only a few scandals" in procurement such as "the kind of cost overruns we have experienced in the last decade."
>
> "This national consensus . . . will quickly turn to outrage if the taxpayers see too many more defense dollars going to pay for cost overruns, delays and gold-plated 'tin lizzies' instead of effective military equipment," Roth said.[2]

In this environment, we have every right to ask: "Can we afford the 32 acquisition improvement actions; in particular, those 13 actions that require money up-front?" When I posed this question to Mr. Vincent Puritano, Executive Assistant to the Deputy Secretary of Defense, his answer was direct and to the point: "Can we afford *not* to implement the actions?" The rationale is equally

1. During the past three and a half decades, the longest period of sustained real growth in the DOD budget has been 3 years. Since we had a real growth in FY 80 and FY 81, FY 82 is the third year in the most recent 3-year sequence.
2. Morton Mintz, "Pentagon Says B1 Cost May Rise $1 Billion," *The Washington Post* (28 October 1981), p. A4.

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straightforward: By investing up-front as required by the 13 actions, DOD will save significantly greater funds in the future, thus creating opportunities that would not otherwise exist.

The objective of this paper is to describe each of the 13 acquisition improvement actions in some detail, indicate the implied investment required, and estimate the cost-benefit ratio and the cost avoidance.

Before we begin, it is important to recall that decisions made very early in a program determine the costs throughout the life of the system. This fact is graphically illustrated in Figure 1. Note that decisions made during the concept exploration phase fix approximately 70 percent of the life-cycle costs, and that roughly 85 percent of the life-cycle costs are locked in before full-scale engineering development even begins. It is obvious, for example, that decisions concerning the top speed and turn rate of a new aircraft strongly influence the materials and manufacturing methods (aluminum vs. titanium vs. graphite epoxy, sheet-stringer vs. superplastic-formed-diffusion-bonded, etc.). Equally obvious is the fact that decisions with respect to the logistics strategy establish the operational and support costs for the life of the system.

FIGURE 1
Life-Cycle Cost of a Typical Weapon System

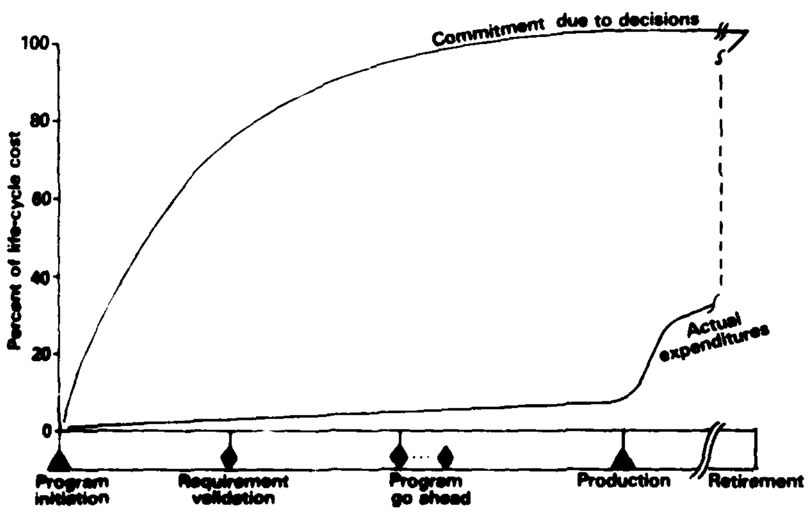

Figure 1 also illustrates that expenditures up-front are but small fractions of the total life-cycle cost of a system; indeed, roughly 90 percent of the life-cycle cost is incurred after the production decision milestone. This is indicative of the large leverage that expenditures up-front can have on expenditures later in the program. As a rule of thumb, one has a strong justification for spending money up-front when such an expenditure shows promise of achieving significant savings (in constant-year dollars) downstream. Even in this context, however, there are many other factors that must be evaluated—factors which may dictate that one follow an economic path that is far from the optimum. Many of these other factors will be pointed out as we progress through the paper. With these thoughts in mind, let us proceed through an examination of each of the 13 actions.

Pre-Planned Product Improvement (P³I—Action 2)

Pre-planned product improvement differs in two respects from the classic "product improvement" with which we are familiar. First, in a typical P³I program, the product is designed "from the ground up" with eventual improvement in mind: interfaces are provided, and volume, weight, cooling, electric power, etc., are allocated for the anticipated improvement. Second, development of the *improvement* is pursued in parallel with development of the basic product.

A typical P³I program has two principal costs: the cost of developing an improved technology in parallel with the basic technology, and the cost of preparing the basic product to accept the improved technology. Note that, in the bigger picture, the costs are not restricted to the financial realm. Particularly for small weapon systems, a P³I program can impose significant penalties on the basic system (because of the requirement for added weight, volume, power, etc., needed to accommodate the product improvement). There are also the costs of retrofitting the product with the improved technology, and there are the logistics complexities owing to the presence of two (or more) variants of the product in the inventory simultaneously.

These costs are offset by significant advantages. For example, the initial operational capability (IOC) need not be delayed by the technical difficulties that often plague state-of-the-art technologies. In addition, because the product is initially fielded with more mature technologies, its initial operational and support costs are typically less than those encountered in a more technologically advanced product.

The principal advantage of P³I, however, stems from the fact that the product can be upgraded (to meet future threats and to yield greater capabilities) through an orderly process. Indeed, a suitably upgraded product can often obviate the need for a "next generation" system, thus saving the cost of an entire develop-

ment program. Thus a P³I program must be viewed as a long-term investment with a payoff in the 10-year time frame.[3] The potential cost avoidance is the cost of development of a next generation system less the cost to achieve equivalent capability through P³I. In this context, the cost-benefit ratio could be as high as 4:1.

There are, of course, reasons other than cost avoidance for carrying out a P³I program, such as keeping alternate technologies alive and stimulating competition, but we will not go into those here.

Multiyear Procurement (Action 3)

Multiyear procurement was among the most hotly discussed items during the deliberations leading to the FY 82 Defense Authorization Bill (HR 3519). Ultimately, the cancellation ceiling (the limit of government liability should the program be cancelled) was set at $100 million; 5 years was chosen as the maximum length of a multiyear procurement contract; and the decision was made to allow the cancellation ceiling to cover recurring (as well as non-recurring) costs.

Although the benefits of multiyear procurement accrue to the government both in non-recurring and in recurring costs, the greater benefits are frequently found in the latter area. Because the contractor is permitted to purchase and fabricate certain items in economic lot sizes capable of fulfilling the needs of the entire program, set-up and other up-front costs for these items are incurred only once during the program (instead of each year under current arrangements).

The cost avoidance attributable to multiyear procurement is strongly dependent on the type of item to be procured. At the one extreme, the government procures very large numbers of small items such as ammunition. Even in this case, multiyear procurement can yield significant savings. For example, in 1980 the Air Force issued a 3-year contract for the purchase of ammunition for the GAU-8 gun in the A-10 aircraft. The projected saving (by comparison with three 1-year contracts) was 9.3 percent.

At the other extreme, the government buys a small number of large items such as satellites. Aircraft occupy an intermediate zone; a surprisingly large proportion (sometimes greater than half) of the components for such systems are suitable for purchase in economic quantities. The AN/ALQ-155 power management system for the B-52 aircraft is an example of an intermediate system; the 3-year contract for a total of 174 units was valued at $54.2 million and had a projected saving of $10.6 million.

3. In the view of many authors, the time required for a new technology to overtake an older technology is roughly 10 years; however, the pace of development in the computer field is much more rapid.

These two examples are typical, and illustrate the fact that a multiyear procurement strategy can yield a cost avoidance as high as 10 to 20 percent of the cost of the program.

Needless to say, when the government allows the contractor to spend money up-front for productivity improvements and economic lot buys, it also incurs financial liability in the event the program is cancelled. As noted earlier, the statutory limitation on this contingent liability (the cancellation ceiling) is $100 million. There is, at present, a great deal of discussion as to how this contingent liability will be handled. The Office of the Secretary of Defense (OSD) is leaning toward a conservative posture in which the services will be required to budget for the cancellation ceiling, thus removing this money from the available obligation authority. In future fiscal years, OSD may adopt a form of self-insurance in which a single account is established (equal to a small percentage of the total contingent liability for that fiscal year) for use by the services in meeting the obligations incurred by program cancellations.

If the current policy were revised to eliminate the requirement to budget for the cancellation ceiling, there would be no additional up-front cost authorization required by the government; funding would be required only in the unlikely event of cancellation.

Capital Investment (Action 5)

Action 5 contains eight initiatives designed to strengthen the defense sector of the industrial base by stimulating capital investment and facilitating cash flow. Four of these initiatives will ultimately require expenditure of funds up-front.

—Accelerate capital equipment depreciation. The new tax law already permits more rapid tax write offs. The OSD is currently seeking authority to revise the cost accounting standards (CASs—including CAS 409) to make them compatible with the schedule in the new tax law.

—Provide contractual incentives for increased productivity and maintainability. Incentive fees and award fees appear to be particularly effective vehicles.

—Provide profits commensurate with risk and investment. The thrust of this initiative is to encourage investment on the part of the contractor by removing some of the traditional ceilings on profits. Guidelines are being developed. The 1982 Defense Authorization Act cancelled the Vinson-Trammell legislation, thus abolishing the statutory limitation on profits for aircraft and shipbuilding.

—Employ equitable economic price adjustment (EPA) clauses. The OSD is particularly concerned that the prime contractors extend equitable EPA clauses to the subcontractors.

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The principal returns on these initiatives will accrue during the mid- to long-range time frames as contractor productivity improves. The concurrent strengthening of the industrial base will, of course, have very long-range benefits. Although it is difficult to estimate the return on this investment, a cost avoidance of about 10 percent of the value of the program should be realized.

Manufacturing Technology (Within Action 5)

All the services recognize the benefits to be realized from exploiting manufacturing technology (ManTech). One of the primary objectives of ManTech is to increase manufacturing productivity through the introduction of new materials and manufacturing processes. A substantial portion of ManTech resources is devoted to projects classed as "generic"; that is, projects that address technologies that are widely applicable across the defense sector. A typical example is the technology for superplastic-formed-diffusion-bonded (SPF/DB) titanium structures. This new technology is designed to replace the older and more costly "sheet-and-stringer" technology for building up titanium structures. Under sponsorship of the Air Force ManTech program, the SPF/DB technology was introduced and proof tested on the plant floor at several aerospace contractors. Sample components (such as aircraft access panels and wheel well doors) were fabricated and tested in an operational environment.

ManTech resources are also committed to much nearer term objectives. A case in point is the F-16 technology modernization program. The objective of this program was to reduce the cost of F-16 aircraft through selected productivity improvements. To this end the Air Force invested about $25 million of ManTech money, and General Dynamics invested approximately $100 million to purchase capital equipment. The anticipated cost avoidance is $370 million; of this, the Air Force will realize a saving of $220 million in cost of F-16 aircraft, and the remainder will accrue to the contractor as a return on his investment.

A typical ManTech project has a large cost-benefit ratio, commonly as high as 10:1. Indeed, ManTech projects are rarely funded by the services unless very substantial benefits appear achievable. In addition to their large cost-benefit ratios, ManTech projects yield substantial improvements in surge capability. It is therefore not surprising that there is stiff competition for ManTech support.

Economic Production Rates (Action 7)

A common cause of non-economic production rates is a program stretch-out in which programmed funds are diverted to satisfy other requirements. A program stretch-out invariably increases the unit production cost, since the overhead costs remain fixed and must be distributed over fewer units. The up-front costs

required to maintain a stable, economic production rate can be substantial; they are, of course, recovered at the end of the production contract. The cost avoidance can be up to 15 percent of the cost of the program. The concept of a cost-benefit ratio is meaningful only if funds are added to the program to change the baseline rate to a more economic rate; in this case, the cost-benefit ratio may be as large as 1.5:1, depending on the degree of program compression. Establishing and maintaining an economic production rate has an additional advantage in that it creates a climate of program stability, which in turn encourages the contractor to make long-term investments to enhance productivity.

Still, there are circumstances in which the best interests of the government may not be served by maintaining economic production rates. For example, the requirement to maintain a "warm production base" may demand that the production rate be far from optimum. Conversely, the need to field large quantities of a system quickly may create a situation in which inefficiencies are attributable to a rate that is greater than optimum.

System Support, Reliability, and Readiness (Actions 9 and 31)

Inasmuch as operation and support costs constitute roughly 60–70 percent of the life-cycle cost of a typical system (see Figure 1), significant savings can be achieved through investments up-front to increase reliability and simplify maintenance. Both research, development, test, and evaluation (RDT&E) and production funds are required. The RDT&E funds are used primarily to design an inherently reliable and supportable system, and to thoroughly test the system, particularly in a realistic environment. The added production funds are required to incorporate those features which increase reliability, ease the maintenance workload, and simplify the required maintenance operations. As cases in point, consider the F-15 and F-18 aircraft, both of which have large numbers of line replaceable units (LRUs) that can be accessed without the need for work stands.

Since the pay-off is measured in terms of life-cycle costs avoided, the pay-back time is quite long. However, the benefits to be achieved are significant—the cost avoidance can be as high as 10 percent of the life-cycle cost of the system, and the cost-benefit ratio varies from break-even to 6:1.

Spending money up-front has an additional advantage of vital importance: It assures greater operational readiness (higher mean time between failures and shorter time to accomplish maintenance actions) throughout the life of the system.

Front-End Funding for Test Hardware (Action 12)

The primary objective of Action 12 is to hold the line on risk while allowing the program to move out on a fast track. This objective can be achieved if funds are allocated up-front for additional test hardware so that adequate development and operational tests can be conducted. In many cases, this will necessitate significant amounts of concurrent development and operational testing.

Action 12 also stresses the importance of combined environmental tests and the importance of the test-fix-test process. In all cases, the emphasis is on the acquisition, early in the program, of adequate numbers of test items.

To the extent that risk is held in check, the up-front funding for test hardware results in avoidance of costs that might otherwise be incurred to correct unforeseen technical problems; however, cost avoidance is not the primary goal (or result) of this action.

Standard Operational and Support Systems (Action 21)

Although this initiative echoes the oft-heard dictum to increase the use of standard operational and support systems, its principal thrust is to stimulate development of standard subsystems and the associated technology for use in future weapon systems. *Action 21 places particular emphasis on support systems* and explicitly recommends that a logistics RDT&E program be supported.

The pay-off is obviously long term. To the extent that a standard system or subsystem are selected "off the shelf," costs are avoided; the cost-benefit ratio can be 2:1 to 5:1, or even higher if a common stem is selected for several weapon systems.

Competition (Action 32)

There are a variety of reasons for seeking to enhance competition.

—To stimulate innovation
—To maintain a "warm technology base"
—To ensure a quality product
—To stimulate contractor commitment to the program
—To maintain a "warm production base"
—To develop a second source and increase surge capability
—To stimulate production efficiencies

Of these, only the last is directly aimed at reducing cost (and the others can often lead to increased costs). The cost avoidance attributable to production efficiencies can range between 10 and 30 percent of the value of the program. As a case in point, consider the results of the Army's analysis of large ammunition buys where there is "room" for two or more contractors. Richard C. Brannan,

who studied Army ammunition acquisition in detail, notes the following rule of thumb for ammunition items: ". . . competition with split awards reduces the unit price by an estimated 7 percent."[4] The cost-benefit ratio must, of course, take into consideration the cost of establishing and maintaining a second source. Not surprisingly then, the cost-benefit ratio may range from 0.5:1 to 1.5:1, and the decision-maker must evaluate many parameters (such as the other benefits listed above) in addition to the economic factors.

Other Actions

Four of the other actions may be conveniently grouped because they share a common goal—program stability.

—Program Stability (Action 4)

—Budget to Most Likely Cost (Action 6)

—Budget Weapon Systems for Inflation (Action 18)

—Improve Source Selection Process (Action 20)

All too often, the common denominators for our major acquisition programs are "cost overrun" and "program stretch-out." A frequent culprit is intentional underpricing (not uncommonly encouraged by government practices) followed by attempted recoupment by the contractor (an apparent overrun). A cursory examination of the 30 September 1981 Selected Acquisition Reports (SARs) indicates the prevalence and tremendous cost of program turbulence. With respect to the acquisition strategy laid down at Milestone II, 38 of the 45 programs catalogued had experienced changes in the number of units to be procured, and 39 had experienced schedule changes. The cost growth for these 45 programs, again with respect to the Milestone II baseline, was 113 percent; of this, two-fifths was attributed to quantity and schedule changes.

The common theme of the four actions listed above is (1) to develop more realistic cost estimates, (2) to plan and budget accordingly, and (3) once we have developed a coherent plan, stick to it. The issue is not one of adding money up-front to do something that would otherwise not be done; rather, the emphasis is upon providing the necessary funds up-front so that the program can be executed *as planned.*

Normally, one would not define a cost-benefit ratio for this type of expenditure. However, as one examines the impact of program turbulence, it is apparent that there is a significant pay-off in holding to the initial schedule. The cost avoidance can be up to 25 percent of the total program.

4. Richard C. Brannan, "Forecasting Savings from Repetitive Competition with Multiple Awards," Ninth Annual DOD/FAI Acquisition Research Symposium (June 1980), pp. 15-7-15-10.

There is another vitally important reason for seeking program stability—to establish credibility both in the eyes of the Congress and in the view of the industrial sector. To the extent that DOD demonstrates that it can control cost and schedule, Congress may back down from micro-managing. And to the extent that defense industry has confidence in the future courses of DOD programs, it will invest resources to enhance productivity.

Conclusion

The results of this analysis are summarized in Table I. These data are a composite of my own experiences and my familiarity with pertinent real-world examples. As one reflects on the 13 actions discussed here, it is apparent that although our current procedures have served us well in the past, there are significant opportunities and challenges to improve the acquisition process in the future. It is likewise apparent that no program manager could (or should) apply all 13 initiatives to his program; rather, he must examine the opportunities, select those few with the largest pay-off for his program, and pursue these initiatives vigorously. It will be difficult for the program manager whose program is already baselined to find resources to spend up-front. It may be a little easier for the manager of a new program to introduce initiatives such as pre-planned product improvement and multiyear procurement into the acquisition strategy he proposes for his program. But in both cases, he will be forced to compete with other programs having equally compelling near-term needs. If we have the courage to tackle the challenges—where they make sense—we can have a significant impact on the future. ||

TABLE I
DOD Acquisition Improvement Actions Requiring Money Up-Front

ACTION	FUNDS	FY 82 ISSUE?	COST BEN RATIO	PAYOFF YEARS	OTHER BENEFITS	COST AVOIDANCE
2. PRE-PLANNED PRODUCT IMPROVEMENT	R&D PRODUCTION	YES NO	10:1	10	REDUCES TECHNICAL RISK; FACILITATES UPGRADING IN RESPONSE TO GROWTH OF THREAT	COST OF FOLLOW-ON SYSTEM
3. MULTIYEAR PROCUREMENT	PRODUCTION	YES	2:1*	2-5	INCREASES PROGRAM STABILITY	10-20% OF ACQUISITION COST
5A. CAPITAL INVESTMENT	PRODUCTION	PARTLY	1:1 TO 2:1	3-10	IMPROVES SURGE CAPACITY	0-10% OF ACQUISITION COST
5B. MANUFACTURING TECHNOLOGY	PRODUCTION	YES	10:1 TO 100:1	3-10	IMPROVES SURGE CAPACITY; INTRODUCES NEW MATERIALS AND PROCESSES.	10-50% OF ACQUISITION COST
7. ECONOMIC PRODUCTION RATES	PRODUCTION	YES	2:1	2-5	MORE RAPID INTRODUCTION OF SYSTEMS INTO INVENTORY, CONTRIBUTES TO PROGRAM STABILITY	10-50% OF ACQUISITION COST
9. SYSTEM SUPPORT AND READINESS	R&D PRODUCTION	YES YES	1:1 TO 6:1	3-20	IMPROVED READINESS; CONTROLLED RISK FOR CONCURRENT PROGRAMS	10% OF LIFE-CYCLE COST
31. IMPROVE RELIABILITY AND SUPPORT	R&D PRODUCTION	YES YES	1:1 TO 6:1	3-20	IMPROVED READINESS, CONTROLLED RISK FOR CONCURRENT PROGRAMS	10% OF LIFE CYCLE COST
12. FRONT END FUNDING FOR TEST HARDWARE	R&D	YES	N/A	2-3	SHORTENED ACQUISITION CYCLE WITH CONTROLLED RISK	N/A
21. DEVELOPMENT AND USE OF STANDARD OPERATIONAL AND SUPPORT SYSTEMS	R&D	YES	2:1 TO 5:1	5-20	SIMPLIFIES LOGISTICS SUPPORT	COST OF DEVELOPMENT OF NEW OPERATIONAL AND SUPPORT SYSTEMS
32. COMPETITION	R&D PRODUCTION	YES YES	0.5:1 TO 1.5 TO 1 0.5:1 TO 1.5 TO 1	5-10 3-5	STIMULATES INNOVATION; ENSURES A QUALITY PRODUCT; INCREASES SURGE CAPACITY; MAINTAINS WARM TECHNOLOGY BASE; MAINTAINS WARM PRODUCTION BASE.	-50% TO +30% OF ACQUISITION COST
4. PROGRAM STABILITY	R&D PRODUCTION	YES YES	1.3:1 TO 1.5:1	2-5	DEVELOPS CONFIDENCE IN VIEW OF CONGRESS AND INDUSTRY; DEMONSTRATES EFFECTIVE PROGRAM MANAGEMENT	10-50% OF ACQUISITION COST
6. BUDGET TO MOST LIKELY COST	R&D PRODUCTION	YES YES	1.3:1 TO 1.5:1	2-5	DEVELOPS CONFIDENCE IN VIEW OF CONGRESS AND INDUSTRY; DEMONSTRATES EFFECTIVE PROGRAM MANAGEMENT	10-50% OF ACQUISITION COST
18. BUDGETING WEAPON SYSTEMS FOR INFLATION	R&D PRODUCTION	YES YES	1.3:1 TO 1.5:1	2-5	DEVELOPS CONFIDENCE IN VIEW OF CONGRESS AND INDUSTRY; DEMONSTRATES EFFECTIVE PROGRAM MANAGEMENT	10-50% OF ACQUISITION COST
20. IMPROVE SOURCE SELECTION PROCESS	R&D PRODUCTION	YES YES	1.3:1 TO 1.5:1	2-5	DEVELOPS CONFIDENCE IN VIEW OF CONGRESS AND INDUSTRY; DEMONSTRATES EFFECTIVE PROGRAM MANAGEMENT	10-50% OF ACQUISITION COST

*THIS COST-BENEFIT RATIO (2:1) ASSUMES THAT THE SERVICE IS REQUIRED TO BUDGET FOR THE CANCELLATION CEILING. IF THIS REQUIREMENT IS REMOVED, THERE WILL BE NO NEED TO SPEND FUNDS UP-FRONT AND THE CONCEPT OF COST-BENEFIT RATIO LOSES MEANING.

Defense Acquisition: A Game of Liar's Dice?

Dr. Walter B. LaBerge

The purpose of this paper is to suggest important actions that can and should be taken to improve the defense acquisition process. Although the actions I suggest differ from those already promulgated as part of DOD's acquisition improvement program, they are not inconsistent with that program. [See "Department of Defense Acquisition Improvement Program," *Concepts*, Autumn 1981.] In fact, these proposed actions complement those already under way.

Prior attempts at improving defense acquisition have centered on improving the process without attacking the strong environmental motivations that make people behave the way they do. The DOD procurement system performs in a non-optimal way with large overruns and delays because the environment *forces* that behavior. Therefore, the only way to get more reliable budgeting and execution is to adjust the environment to reward only that performance. Simply put, in order to improve acquisition, DOD must better reward the behavior it wants and penalize that which it doesn't want. This is exactly the opposite of the way it operates now, which is to reward unrealistic promises and never penalize poor performance.

Liar's Dice

To get a feeling for the underlying problem, the following analogy may be useful. The DOD acquisition system is very much like the barroom game of "liar's dice." In that game, winning comes from concealing the true facts (e.g., the roll of one's dice) and by asserting not what *is* but rather what *might be*. To win, the player must put forward the most optimistic assertion that has a chance of being believed by someone not knowing the facts in detail. One who straightforwardly and honestly describes his situation rarely wins against the veteran liar's dice player. The same rules seem to prevail in DOD.

The players in the acquisition process have the same environment as does the player of liar's dice. It is generally conceded to be exceedingly risky for a military officer or a civilian contractor to be open, honest, and conservative. It is far less risky to make grand promises and conceal what is really going on. As a result, we are forever being surprised by programs that suddenly emerge into the limelight grossly overcommitted and underfunded.

To see how this happens, let me give my perception of the defense contractor environment. At the outset of a program, our DOD bid process encourages

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substantial contractor overoptimism in technical accomplishment, in schedule, and in cost. The contractor environment is one of competition to win the support of the evaluators of the proposal; thus the contractor very much caters to the evaluators' interests. Most major requests for proposals (RFPs) are evaluated by service technologists who will not themselves have a role in implementing the program, which means they are not dominated by implementation interests. In fact, these technologists have little experience in cost control or production implementation and so frequently are not competent to judge implementation issues. They do, however, have a high interest in trying to exploit in operation the most taxing technology. The technologists can see only the merit of new techniques, not their difficulty—and they are the judges.

In the main, the program office that is to execute the work is given the program only after the major characteristics of schedule, technical risk, and costs have been decided and cast in concrete. In practice, they cannot reject an unrealistic program. In fact, seldom does a program manager have a chance to really understand the quality of his going-in position before he is bound, contractually, to its execution.

The contractor proposal is most usually the basis for all execution planning, even though "promising the moon" is known to be the key to successful contract award. Proposal writing in the last few years has become liar's dice in its ultimate embodiment. There is no disincentive to writing a barely credible proposal that can match the disincentive to writing a conservative proposal; namely, the loss of the award.

Not only does DOD provide no disincentive to the low-balling of bids, it further hurts itself by not including in its long-term estimates the cost reserves necessary to compensate for the unrealistic bids.

The Fallacy of Fixed Price

To further complicate matters, there is the erroneous belief on the part of the acquisition community that R&D procurement with fixed-price initial production options helps improve cost credibility. Nothing could be further from the truth. If anything, it hurts cost realism. These fixed-price procurements do nothing to obtain better bids, but do much to deny the government the cost information that is much more available to it in a cost-reimbursement environment.

A contractor today is asked to bid fixed-price in competition with another vendor on development and up to 10 percent of the expected long-term production. Each contractor knows that if he can win the first competitive bid, he will be facilitized by the government or assured of a contract that will allow him write-off facilitization, that he will have a labor base to absorb his fixed overhead, that

he will be able to absorb company-sponsored future development work, and that he can eventually make a profit. He knows that if he loses he will be unable to do any of these things. In fact, without a new labor base he may spoil the profitability of his present contracts. The contractor also knows that he is reasonably safe from punitive action. He knows that the defense acquisition regulations (DARs) assure him that he will be paid real costs and a fair fee for the remaining 90 percent of the production which by then will no longer be in competition. He also knows that in today's application of the DARs his fee on the non-competitive 90 percent is not determined by the dimensions of the exaggerations he may have told to get the job in the first place.

In light of all these considerations, today's contractor inevitably explores how low he can bid on the competitive 10 percent and still make out on the fees, overhead, G&A, and benefits of the non-competitive 90 percent.

The only real disincentive to a low-balling bid is the possibility of problems with cash flow on a gross underbid. But good, strong companies (and many others not so strong) are willing in this kind of competition to risk quite a cash flow hit if the benefits can be expected to be great enough. This situation is quite unrealized by DOD today. Because of it, DOD actually limits its major contract bid structure to only the very rich. And of these, many well-capitalized, competent, economically well-managed companies no longer want to use their venture assets to subsidize the government for many years before making a profit. In a sense, we eliminate just the kind of contractor we ought to want; namely, the one who is good enough to have options with what to do with his surplus cash. Instead, we keep the ones who have no other options.

If you don't believe this, look at the percentage of DOD business compared to commercial business done by our top 25 DOD contractors. It has steadily dropped over the last 10 years from about 30 percent to less than 10 percent. We are not a business to put money into if a company has an option.

For those few companies who can afford and wish to play the DOD game, having figured how low they can go, they now need to fabricate a liar's-dice-like proposal. As in liar's dice, in DOD acquisition you really need to know your opposition. By trial and error, industry by now has that well figured out. They know that their liar's-dice proposal is to be made to a set of people who have every incentive to believe an overoptimistic, barely credible technical, schedule, and cost commitment, and who have a reputation for rejecting conservative offerings. So, small wonder the offerings are expansive.

The management level above the progam manager is itself swept up in its own liar's-dice game. The figure of merit by which senior officials are scored is how well they can convince their military and civilian superiors that their own pro-

gram should be funded instead of someone else's. To do this they also need programs which can be promised quickly and at low cost. They too will be long gone before the results of their promises are evident. In sum, no one benefits from being conservative. Everyone benefits by being unrealistic. All the incentives are on selling. None of the incentives are on performance, at least at the time the initial program decisions are made.

Disincentives for Facility Investment

Another important, infrequently considered, aspect is that from the contractors' standpoint there is still little, if any, incentive to use their own money to improve their facilities so as to bring down production costs. There is, however, every incentive for them to use their facility money to move into new areas of R&D, and to facilitize to win new contracts by demonstrating, on their own money, new technology.

Why should contractors spend their money to reduce their fees (since fee scales with cost) unless the resulting improved production capacity puts them in line for new business? Even if a contractor is greatly overrun on the initial 10 percent, there is still little incentive to use company investment to reduce downstream production costs. The threat of a second source is the only threat that works to force company investment, but the size of our production runs rarely allows second sourcing.

In fact, because production runs are not long enough to permit amortization within an individual contract, special tooling is a dangerous, not an enticing investment. The company involved has to bet its cost recovery on what seem to be unstable and capricious DOD and congressional procurement quantity decisions. A buy-back program on specific tooling might alleviate this disincentive, but has yet to be made an accepted practice in DOD. I am not at all sure that DOD really realizes (even though it talks about it all the time) how serious this disincentive to facilitization really is.

The net result of the environment I've described is to encourage unrealistic bidding, to use this bidding as the basis for unrealistic total program budgeting, and to provide little, if any, incentive for a company to spend its venture capital for cost-reducing tooling.

A Deteriorating Competitive Environment

Why is all this still the case, when every administration since WWII has been trying to improve the acquisition process? It is in my view, curiously enough, that the DOD systems acquisition process had, in fact, been steadily improving. I admit that its results seem awful by almost any measure, and that this makes it

look as if we are doing much worse, not better. What is missed by casual observers is that a modest but steady DOD improvement has been swamped by a very great deterioration of the competitive environment in which the process works.

Costs of individual programs have gone up much faster than has the overall budget. So there are necessarily fewer new programs, even though each is more expensive. For example, where the United States once had 12 or so aircraft programs ongoing at any one time, we can now only foresee three or four new aircraft in concurrent production. As a result, contract opportunities have become few and far between and the compulsion to win the only games in town very high. Competition for the available jobs has become so much more vigorous that the resultant temptation for unrealism has far outreached DOD ability to control it.

Turning to suggestions as to what to do—they split into those actions that favorably change the contractor environment and those that can favorably change the service environment. In order to fix on a manageable number of implementable suggestions, I have down-selected to just four each for industry and government. I will list them first and then expand on them individually.

Industry Environment

—Make as a condition of all bids that down-select to a single production contractor, that fee and G&A recovery for the entire contract will be scaled to how well downstream production costs correspond to the estimates made at the time of down-selection.

—Make as a condition of contracts leading to production that full amortization of production tooling investment be guaranteed or that the tooling will, if desired, be bought back by the government. In either case, the contractor must be compensated fully in this facilitization for out-of-pocket costs *including costs of money*.

—Provide the professional manpower to institute an obligatory government "should cost" process that does not allow (except by service system command approval) award of production contracts whose costs vary more than 10 percent from government estimate.

—Ensure that the team that evaluates proposals for a program has the responsibility for executing that program. Do not let the off-line technologists determine the contractual commitments.

These four suggestions, in sum, attempt to make it much more profitable for the vendor and his competition to bid realistically than to play liar's dice in his proposal.

Government Environment

—Make as a rigid matter of practice that tours of duty of program managers be 4 years and ensure that they be assigned PM status at the beginning of their career in grade (O5, O6, or O7). This will ensure, at the time of next selection opportunity, that the true measure of PM performance can be ascertained.
—For PMs who are with a program less than 4 years, institute a formal follow-up officer evaluation reporting system that requires that 2 years after any PM's departure he be re-evaluated by the service systems commander in terms of the accuracy of his representations at the time he departed the program.
—Institute an audit-by-exception program that reports to the chief of service rather than to the systems command. This spot-check audit would be conducted by the service in a manner parallel to that which the Inspector General performs for other parts of the service.
—Provide 6-8 weeks' overlap of senior personnel to allow adequate time for the new man to understand what he is taking over.

These four suggestions again strive to make possible for the government official an environment in which he may to do his job in an open manner and which discourages covering up difficulties.

Keying downstream profit and G&A on a large, single contractor program to the commitments made during competition is crucial. It is one of only two ways to incentivize accurate forecasts of production costs. The other is to maintain competition through the life of the programs. In most cases, the alternative of continued production competition is not practical. Since we have not so far keyed downstream profits to initial commitments, there are now no disincentives to playing liar's dice in a proposal.

The second suggestion tries to make production facilitization more profitable and less risky than is the case today.

The third suggestion is that compliance of bidding to "should cost" expectation be required. These "should cost" estimates ought to require the blessing of the senior systems command cost specialist. The idea here is to reduce the chance that the development community, in its enthusiasm, will fail to obtain good advice on probable program costs. Under this formulation, the only way for a program whose estimates fall outside the should-cost bounds to gain approval is for that program to get the explicit agreement of the head of the systems command. Knowing that this comparison with should cost will take place and that differences will be adjudicated at the system command level should reduce the willingness at lower levels to condone overoptimism. This, in turn, should produce an industry environment that encourages more realistic bids.

To make this should-cost process effective will require substantial augmentation of the cost and financial assets now available within the system.

The fourth industry environment suggestion is intended to let industry deal at program conception with the group that will implement the program, and therefore the one that has the greatest motivation to encourage realistic offerings.

The fifth and sixth suggestions attempt to remove the tremendous incentive that now exists for a program manager to conceal problems until after his officer evaluation report (OER) is written and he has departed for another assignment. Far and away the best way to do this is for the manager to be with the program long enough to have its results evident. A 4-year PM tour is an efficient use of this skilled manpower. For officers who cannot be retained for 4 years, the concept of a 2-year-later supplementary OER, done by the service system commander, seems equitable. This proposal, although novel, ought to be viewed positively by those honest, open managers who are in competition with those who may conceal information.

The seventh suggestion is bound to be unpopular, but hardly anyone in service or industry runs a major activity without having an audit chain directly from its chief executive officer to the place where implementation actions of major consequence take place. All good industries have this spot-check audit capability in one form or another. The military services themselves audit their principal business. They have inspector general (IG) teams who audit the administrative and readiness performance of an activity. This occasional audit from the top has always had a therapeutic effect by routinely causing everyone to report as if he were the one to be inspected soon.

I cannot emphasize enough the importance of the occasional top-level performance audit. It is even more important in DOD than industry because of the ever-lengthening duration of our programs. One simply cannot wait for a program to be completed to gain understanding of its technical, schedule, and cost situation. Reliable ongoing status reports are required. It is my view that the only way to ensure that these reports are accurate and forthcoming is to install the high-level, off-line audit. Otherwise, incentives for accuracy and openness in in-process reporting do not exist.

The last suggestion, that of substantial program manager overlap, can give the prospective manager time to learn the nuances of his program before being required to assume all of its commitments. As it is now, in his first month a new program manager seldom has a chance to do more than flail at daily problems without understanding their context. The less experienced a manager, the more should be the overlap. This is seldom the case. The normal environment encourages very bad mistakes by a too-abrupt transition.

Let me conclude by insisting, as I did at the beginning, that exhortation alone will not substantively improve performance. Contemporary market conditions, combined with DOD policies, have created an environment that does not favor conservative planning and openness in execution. Unless this environment is changed, not a great deal can be expected from the initiatives of the current administration.

Lest you think I am exaggerating about the difficulty of being honest in today's acquisition environment, just ask a few senior program managers both in industry and the military whether it is true or not. I've talked to enough military and industry senior executives to feel positive that they would agree (privately and off the record) that today's environment is really that of liar's dice and that it is almost impossible for anyone to be as honest and straightforward as he would wish to be.||

Augustine's Laws and Major System Development Programs (Continued)

64

Norman R. Augustine

(The Defense Systems Management College published the first installment of "Augustine's Laws and Major System Development Programs" (Laws I-XV) in the Spring 1979 issue of the Defense Systems Management Review *(Vol. 2, No. 2). Since then the author has added eight more "laws," which we are pleased to make available to* Concepts *readers. The American Institute of Aeronautics and Astronautics plans to publish, in the near future, the complete collection of 23 laws in hardbound form. This installment of "Augustine's Laws" takes up where the first left off—at Law XVI and Figure 21.*

The Manager of the Year

When the going gets tough, everyone leaves.

—Lynch's Law

Law Number XVI addresses the problem of management turnover and is premised on the possibility that most managers, when dealing in a variety of endeavors, think they know their capacity but simply pass out before reaching it.

Certainly, one of the greatest impediments to that fundamental precept of management referred to as "accountability" is the rapid turnover of individuals holding leadership positions. Government program managers in the acquisition process, for example, hold their jobs an average of only 30 months. Even this is a substantial improvement over the situation which existed just a few years ago, in 1965, when such managers retained their jobs an average of only 15 months. Over the last two decades the tenure of the secretaries of the military departments

Author's note: "Augustine's Laws," although sometimes written in a humorous vein to enhance readability and retentiveness, deal with real and serious matters. I offer them in a positive and constructive sense with the hope that they will, by drawing attention to problems and some of their potential solutions, assist in at least some small way toward the strengthening of our nation's defense capability.

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and the Secretary of Defense as a group has been no better, also averaging about 30 months. The consequences of this anonymity in responsibility once prompted an aggrieved Lyndon Johnson to remark, in response to a question by a reporter as to why he had not fired the individual who had scuttled one of the President's favorite programs: "Fire him? Hell, I can't even *find* him."

Could it be possible that so important a management tenent as leadership stability and accountability has been totally overlooked in managing our nation's defense affairs? No, there is reason for optimism. Consider the following newspaper article quoting senior Navy managers: "By constantly changing our . . . director every two or three years, we have destroyed continuity. If you had a million-and-a-half-dollar business, would you want to change bosses every three years for someone who didn't have any experience? Most directors come right from sea duty to this job, and it can take a full year to get to know the ropes. How many people in the Navy do you think know things like scheduling problems?"

Encouraging indeed: The problem *is* recognized. But is this an article from the pages of *The Wall Street Journal* discussing the management of an important new Navy fighter aircraft, or perhaps even a new shipbuilding program? Alas, the article is from the sports pages of *The Washington Post*, addressing the decision reached a few years ago to stop rotating individuals through the position of athletic director at the Naval Academy. At least we have our priorities in perspective.

Gilbert Fitzhugh, Chairman of the Blue Ribbon Defense Panel of the late 1960s, stated the situation in the following terms: "Everybody is somewhat responsible for everything, and nobody is completely responsible for anything." A two-star general once commented, in an outburst of candor in response to a question as to how he was going to work his program out of a seemingly untenable position into which it had descended: "Perhaps a miracle will happen, or else maybe I'll get transferred!"

This problem of personnel turbulence, troublesome in virtually all management situations, is particularly acute in the case of major research and development undertakings. Consider the fact that studies of the frequency of reference to technical articles held in libraries, and of the change of content of course catalogs in the scientific departments of universities, indicate that the half-life of many technologies is today only about 10 years.

Paraphrasing this inconsistency as once pointed out by the *Armed Forces Journal International*, we are attempting to develop major new systems with 10-year technology, 8-year programs, a 5-year plan, 3-year people, and 1-year dollars.

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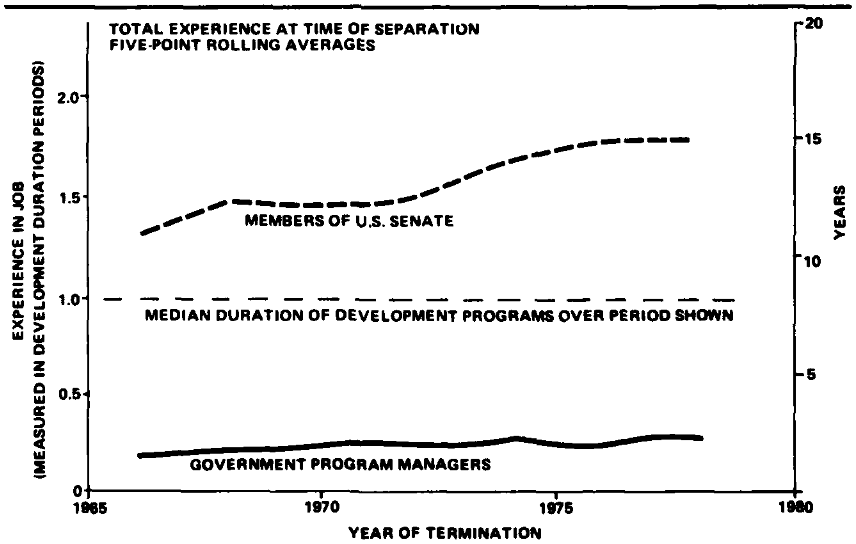
The evidence which underlies Law Number XVI is presented in Figure 21, wherein the longevity of program managers is compared with the (average) longevity of the programs they manage. As also shown in the figure, the people at the top of the legislative structure experience relatively *little* turnover. These numbers of the legislative branch not infrequently remind Defense witnesses testifying before R&D hearings that the congressmen and senators themselves know more about the history and underlying problems of the programs in question than does the parade of so-called experts who appear before them year after year with ever-greater enthusiasm and optimism. It is just this dichotomy, aggravated by the very length of the acquisition process, which in fact leads to the Law of Limited Liability:

> **XVI: The problem with the acquisition process is that by the time the people at the top are ready for the answer, the people at the bottom have forgotten the question.**

FIGURE 21
Personnel Stability in Acquisition Process



Malice in Wonderland

But Benjamin's mess was five times so much as any of theirs.
—Book of Genesis

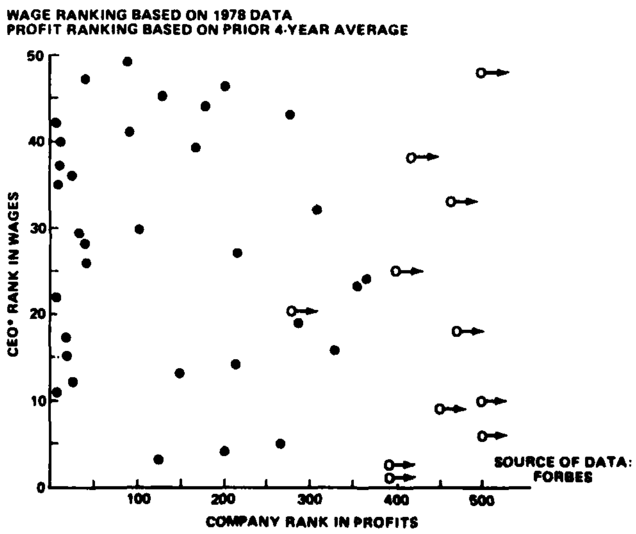
Law Number XVII examines the incentive system—and demonstrates that managers who produce exceptional results can expect the rewards they receive to be increased. Unless, of course, those rewards stay the same or go down.

"Call it what you will, incentives are the only way to make people work harder." The words of Andrew Carnegie? The creed of John D. Rockefeller? Or perhaps of Henry Ford? No, as it happens, these are the words of none other than that old capitalist Nikita Khruschev speaking on the benefits of the incentive program.

Having thus established the manner in which incentives are viewed in the Soviet Union, it is instructive to examine their use in the economic system extant in the United States, for which incentives form the very foundation—the "free-enterprise system."

Figure 22 displays the ranking of the 50 most profitable firms in the United

FIGURE 22
Relationship of Executive Wages to Company Performance



*CHIEF EXECUTIVE OFFICER

States in 1978 as compared with the rank according to pay received of the individuals who led those companies the prior 4 years.[1] The following law, known as the Augustine-Lemeshewsky[2] Law of Distributive Rewards, explains the evidence in Figure 22 (with apologies to P. K. Wrigley of baseball fame):

XVII: There are many highly successful organizations in the United States. There are also many highly paid executives. The policy is not to intermingle the two.

If a plot is made showing rankings according to return-on-equity, the lack of correlation exhibited is even more striking than that found in Figure 22 for absolute profits. The evidence seems to be incontrovertible.

Further, although one could never confuse the operation of the U.S. government with the free-enterprise system, it is still striking that an *overt* effort at demotivation has been practiced whereby the top five layers of management have all been fixed at the identical pay level due to the imposition of an apparently arbitrary wage ceiling.

The Half-Life of a Manager

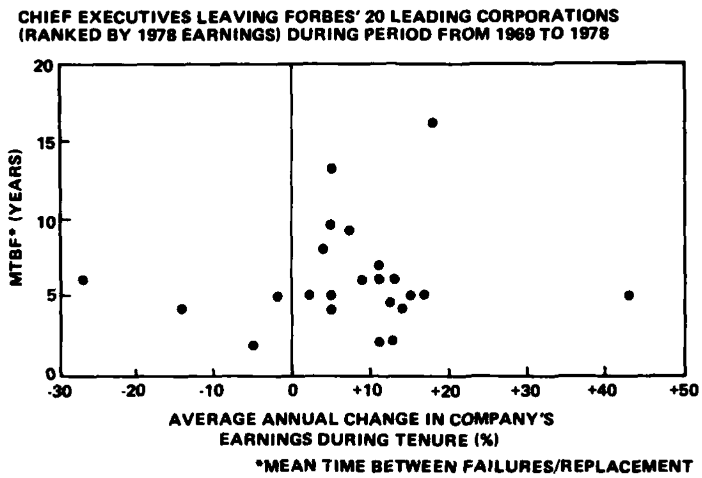
> We have a lot of players in their first year. Some of them are in their last year.
>
> —Bill Walsh, Coach, San Francisco 49ers

Law Number XVIII examines the viewpoint expressed by former Dallas Cowboy Guard Blaine Nye: "It's not whether you win or lose that counts," he says, "but who gets the blame." Will Rogers once pointed out, with respect to his business pursuits, "It is not the return on my investment that I am concerned about; it is the return *of* my investment." Perhaps within this philosophy lies the key to refute the rather disappointing thrust of the previous law.

Possibly the significant consideration with respect to successful managers is not what they *get* from their jobs, but rather that they get to *keep* their jobs. This possibility can be readily assessed using Figure 23, which displays the number of years the top executive in the 20 most profitable firms in the United States, in recent years, has been able to hold his job—as a function of the success achieved by that executive in increasing the company's profits. Unfortunately, the results are doubly disappointing. Not only do they fail to refute Law Number XVII, but worse yet, they call for still another law, the Law of Infinite Mortality:

1. For the occasional instances where the leadership changed during the period examined, the data for that company are not included in the figure.
2. Susan D. Lemeshewsky: Technical Operations Intern, Martin Marietta Aerospace.

FIGURE 23
Executive Survivability



XVIII: Executives who do not produce successful results can be expected to hold on to their jobs only about five years. On the other hand, those who do produce effective results can expect to hang on about half a decade.

It should be possible to fight this form of apathy; but so far it has not been possible to find anyone interested enough to do so. The conclusion of the above law seems to be true over a wide span of profit growth and even over severe profit "retrenchments," as they are gently referred to in stockholders' reports. The correlation coefficient between profit growth and the ability to retain one's job, on a scale where 0 is purely random and 1.0 represents perfect correlation, is calculated to be 0.1. The strongest correlation observed between longevity and any other parameter examined is found to be between the first letter in the name of the company and the first letter in the last name of the chief executive; as in "Ford, Henry II."

A median survival duration of a little over 5 years for top executives may seem rather short at first glance;[3] however, it is really quite good when compared

3. The data sample considered in Figure 23 contains a slight potential bias since the available evidence covers only a 10-year period. The impact of this is to have relatively little effect on the *median* longevity addressed herein; however, the overall (arithmetic) *average* longevity would perhaps increase to 7 or 8 years.

with many other professions such as, say, coaching football. Consider the case of the Washington Redskins coach, who, several years ago, was fired at half-time of the first exhibition game; or the situation that developed a few years later when the team had three head coaches in 24 hours. In fact, in pro football it is clearly a liability to be recognized for outstanding performance. Of the last 15 coaches to be honored by the Associated Press as coach of the year, 11 were fired within the next 12 months. As Bum Phillips, coach of the Houston Oilers, notes, "There's only two kinds of coaches, them that's been fired and them that's about to be fired." (Phillips has since been fired by Houston).

It would seem that to err may in fact be human, but to forgive is, by and large, against company policy. As John McKay, coach of the Tampa Bay Buccaneers points out, "They're paid to catch the ball." It can, of course, be asserted that many of the individuals included in the data base of Figure 23 retired or moved on to more important jobs. But it can be equally accurately asserted that many of these individuals were yet relatively young at the time of their departures and already enjoyed some of the best jobs in America.

Nonetheless, there is no need for discouragement, since the incentive system is, in spite of the above evidence, still alive and well: "People who show the best example in their work must receive greater material benefit"—according to a speech—before the Supreme Soviet—by the Premier—of the U.S.S.R. And right here at home it was recently pointed out that "the challenge for American capitalism in the '80s is to bring the entrepreneurial spirit back to America. Depressed areas especially need an enormous investment of capital. Individual entrepreneurship can create the new work ethic that is so desperately needed in America. To stimulate that ethic America needs creative financing . . . and I intend to work to create it."

So said Jerry Rubin, Yippie leader of the 1960s and a defendant in the Chicago Seven trial—speaking in the 1970s as a security analyst on Wall Street.

The Reliability of Unreliability

Adde Parvum Parvo Magnus Acervus Erit.[4]
—Ovid

The following law deals with the relationship between the reliability of complex hardware and that human tendency reflected in the World War II placebo: "We know of not a single instance wherein the enemy has successfully used camouflage against us." However, with respect to the matter of enhancing

4. "Add little to little and there will be a big pile." Quoted from *The Mythical Man Month* by Frederick P. Brooks, Jr.

reliability, we have in fact *viewed* the enemy; and, to once again quote that immortal possum, "he is us,"—but we seem unwilling to recognize this is the case.

It does appear to be fundamental to the human race to believe that which one wants to believe rather than that which a logical examination of fact would reveal. George Santayana put it in the following terms: "All living souls welcome what they are ready to cope with; all else they ignore or pronounce to be monstrous and wrong . . . or deny to be possible." It would appear that Mark Twain may have been unduly generous toward humanity when he speculated, "I believe that our Heavenly Father invented man because He was disappointed in the monkey."

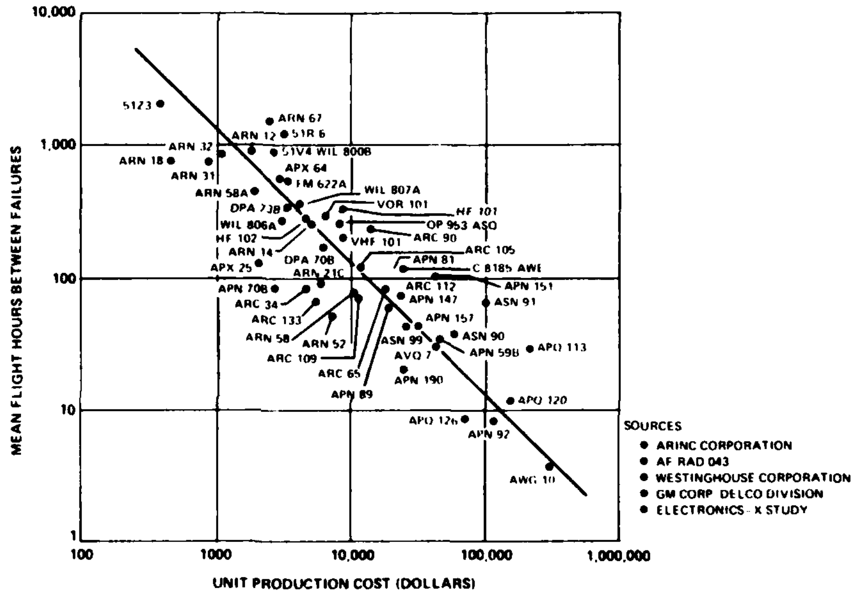
Consider the crucial matter of producing more reliable hardware; and, in particular, electronic hardware, which everyone knows comprises components whose individual reliabilities have been improving at a rate of about 15 to 20 percent per year for nearly two decades. Further, with size decreasing dramatically and the aggregate cost of integrated circuits consistently decreasing since 1963 along a 75 percent learning curve, it should be possible to achieve extraordinary system reliability through careful component selection and built-in redundancy—and thus to eliminate what has been one of the most troublesome problems for electronic equipment users for many years: unreliability.

In the words of Lieutenant General Orwin Talbott, "The longer a man is in a command position on the battlefield, the less enamored he is of the technological edge and the more obsessed he becomes with trying to make what he has work."

Now, if one were not privy to the anachronistic behavior of engineering and management activities as they have been dissected herein, one might in fact unwittingly conclude that as more and more money is spent on an item, its reliability would get progressively better and better. The initiated would never fall into such a logical trap and would recognize immediately that quite the opposite must be true. That this latter situation indeed prevails is verified in Figure 24, which exhibits field reliability data on a number of airborne electronic systems as collected during the Electronics-X study conducted under the aegis of the Institute for Defense Analyses. It is seen that the items examined range from relatively simple devices such as marker beacons and glide-slope indicators, to completely automated multichannel airborne intercept systems. The costs and reliability factors change with increases in inflation and technology—but the trend at any given time remains unwavering. Whatever the spectrum of equipment and techniques involved, the conclusion is unmistakable: As cost increases, reliability does not improve; rather, it worsens. Frank McKinney Hubbard (1868–1930 advises, "If at first you do succeed, quit trying." This is summarized in the Law of Undiminished Expectations:

FIGURE 24
Impact of Increasing Unit Cost on Field Reliability

AIRBORNE ELECTRONICS EQUIPMENT



XIX: It is very expensive to achieve high degrees of unreliability. It is not uncommon to increase the cost of an item by a factor of ten for each factor of ten degradation accomplished.

Dr. Eb Rechtin, President of The Aerospace Corporation, points out that such has been the pace of technological progress that by spending $250 million for an item, a mean time between failure of 30 seconds can be guaranteed. Correspondingly, one might suspect that a mean time to repair of 30 months could be suffered.

Although great care must, of course, be taken in interpreting the meaning of a "failure" (all failures are not created equal, nor do they have equal consequences), data released on the mean flight hours between failure for 12 different types of Navy and Air Force fighter and attack aircraft are illuminating. Nine of the 12 aircraft experienced a "failure" at least once every 30 minutes. Of those, five ex-

perienced failures every 15–20 minutes. This would seem to be conclusive proof of the correctness of those who have argued that the next strategic bomber must be supersonic rather than subsonic.

In any event, it can be understood why there are those who say that an airplane is merely a collection of spare parts flying in close formation.

It should be noted that the above law, regrettably, cannot be limited solely to airborne electronics. For example, even that most "ground-borne" item of military hardware, the tank, is a notorious offender. The M60A2, the first tank having an all-electric turret control system, contained 35,000 parts in the turret alone (and in the field performed for many years exactly like a tank with 35,000 parts in the turret alone). It was, in fact, just such a design which once caused Dr. John Foster, then the Director of Defense Research and Engineering, in an understandable moment of pique, to answer a question as to how one might best defeat a tank assault by saying, "Give them plenty of room to run around and they will all break down!" When considering the enormous logistical burden created by such problems of unreliability, some solace can perhaps be derived from the realization that if the Soviet Union's tanks have no better reliability and repair rates than ours, then with their huge inventory the Russians are stuck with more broken tanks at any given moment than we own altogether.

What, of course, is happening is that as component reliability improves, more components are crammed into each system to provide more and more capability—that is, more capability during those interludes wherein the system is not broken. A modern jetliner has about 4.5 million parts, including 100 miles of wiring. The Nike Hercules air defense system contained well over one million parts. But if a system has one million parts, each with a reliability of 99.9999 percent for *performing some specified mission, the overall probability of the mission failing* is over 60 percent. The foreman of a tank plant perceptively explained the solution in the following terms: "The part you engineers don't put on the machine ain't going to cause no trouble."

Thomas Paine summed it all up in the 1790s when he counseled, "The more simple anything is, the less liable it is to be disordered, and the easier repaired when disordered." Sadly, it has become commonplace to view high technology and simplicity as contradictory terms. The two are not, in fact if not in practice, antonyms. The problem is to use technology in a fashion which engenders simplicity. Who could argue, for example, that today's pocket calculators are less reliable than their 18,000-vacuum-tube predecessor, the ENIAC, which completely filled a room?

Law Number XIX, which states that expensive systems won't work, can be seen to pose a particularly serious dilemma to equipment designers when it is applied in conjunction with Law Number X, which already has noted that inexpen-

sive systems are not possible (they require infinite testing). This all may be academic, however, since it has also been established (in Law Number VIII) that before long it will not be possible to afford any new systems anyway.

FYI

We sure liberated the hell out of this place.
—An American soldier, World War II

Law Number XX addresses the matter of engineers and managers destroying the English language while trumpeting the worth of their activities; or, as the saying in Brooklyn goes, "It was the loudest noise they ever seen."

Most major engineering activities depend on widespread public understanding for their funding or for their social acceptance, if not both. Yet, in spite of the many examples of contributions to mankind made possible through technology, the general public still harbors a considerable skepticism of the net benefit wrought by past technological advances. As a result, budgetary and environmental limitations abound, and support for basic research continues to erode in many quarters. The problem is exacerbated by the very language engineers and managers use to communicate their achievements, a language which appears to be formulated to assure that no information might be transmitted—either to the public or, frequently, among themselves.

A former Principal Deputy Under Secretary of Defense for Research and Engineering, Gerald Dinneen, met this problem head-on, pointing out that "we go to the Congress and tell them that our WWMCCS has got to have a BMEWS upgrade, our Fuzzy Sevens have to be replaced by PAVE PAWS, we want to keep our PARCS and DEW in operation, we have to harden the NEACP, and we have to improve our MEECN with more TACAMO and begin planning to replace AFSATCOM with Triple-S—and then we wonder why no one understands."

The extent of the problem faced by the uninitiated can begin to be appreciated by considering the following excerpt from an Air Force document on the implementation of the new acquisition policy, A-109:

> —The HQ USAF/RD sends the draft MENS through SAF/ALR to OUSDRE for OSAF, OSD, DIA and OJCS staff, level comment.
> —The HQ USAF/RD OPR develops the for-coordination draft MENS and presents the MENS, comments and proposed solution approach to the HQ USAF RRG for corporate review in lieu of the underlying SON(s).

To the unwashed, this might convey a message something like:

—The blank blank/blank blank sends the draft blank through blank/blank to blank for blank, blank, blank, and blank staff-level comment.

—The blank blank/blank blank develops the for-coordination draft blank and presents the blank, comments and proposed solution approach to the blank blank blank for corporate review in lieu of the underlying blank(s).

Clearly, having drawn such a blank when dealing with the process of replacing ROCs (required operational capabilities) with MENS (mission element need statements), GORs (general operational requirements) and SONs (system operational needs), one can understand why there are those who have been able to conclude only that somehow SON of MENS must have been GOR'd by ROCS.

Of course, the liberal use of acronyms and other means of obfuscation does have the advantage of making sometimes pedestrian material appear rather erudite in that it becomes more difficult to comprehend. Who, for example, would pay a medical doctor $20 in exchange for his scribbling on a piece of paper "Take two aspirin"? Hence, the practice of writing prescriptions in Latin or, at the very least, using indecipherable handwriting.

A practitioner who, rather than admonishing "Take two aspirin," could prescribe "Take two acetylsalicylic acid" and, in addition, do so with poor penmanship could very likely qualify as a specialist and thereby command at least $40 for the services rendered.

As might be expected, the potential of uncommunicative communication has not gone unnoticed by the government and other large organizations. That most intimidating of all documents, the federal income tax Form 1040, is generously sprinkled with IRAs, HRs, IRSs, U.S.s, FICAs, RRTAs, R&RPs, EIs, EICs, ZIPs . . . and, ignominiously, something called "WINs."

This striving to impress is also evidenced above the entrances to public buildings, where the inscriptions, presumably for the edification of tourists, are of course offered in Latin. It thus may be that no one really knows what *E Pluribus Unum* really means . . . but no one can question that it is impressive.

A few years ago when in the midst of the national anti-ballistic missile debate the name of the then-troubled Zeus missile was changed to Spartan, it was only a matter of hours until some knowing wag had posted a sign on a Pentagon bulletin board proclaiming: "Spartan: Special Political Advantages Realized Through Advanced Names." A few years later, the oft-analyzed but never-deployed advanced manned strategic aircraft, AMSA, became known among its much-suffering advocates as "America's Most Studied Aircraft."

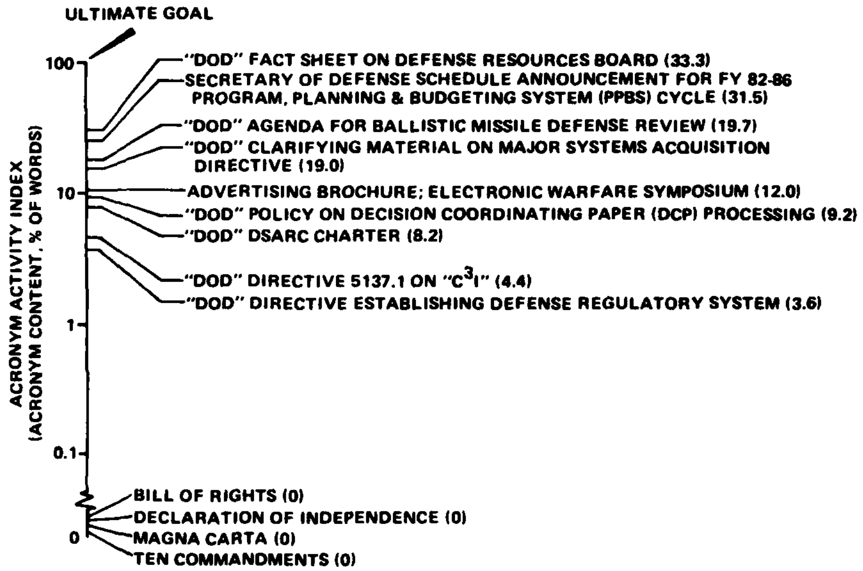
Similarly, at a security gate at Cape Kennedy on the approach to one of the launch pads is a sign which, among a number of cautions about explosives, flammable liquids, falling objects, high voltages, etc., conspicuously warns visitors that "POVs are prohibited." Now, this is, of course, cause for consternation among those who may wish to enter but are somehow not exactly certain whether they have a POV in their possession. It therefore can be with no inconsiderable relief that one learns that a POV is merely governmentese for "privately owned vehicle," i.e., presumably a shortened form for the word, "car." Correspondingly, a "range extension system," better known as an RES in guided bomb parlance, is, in less knowledgeable circles, merely referred to in its short form as a "wing"!

There are those individuals, both outside the government and inside, who are endowed with that special talent to take fairly straightforward concepts and, through suitable embellishment, make them quite nearly incomprehensible. The original lucid statement of the acquisition policy which David Packard, then Deputy Secretary of Defense, was to promulgate for the Department of Defense was written by himself and had an acronym content of only 0.2 percent of the words contained therein. However, by the time this statement was translated by acronymologists (so it could, presumably, be more readily understood) into the regulation which underpins much of the Defense Department's present acquisition policy (DODD 5000.1), acronyms comprised fully *10 times* the above fraction of all the words in the document. It seems doubtful, indeed, that Deputy Secretary Packard would ever recognize his policy in its new, improved form.

It is suggested that there are those who believe that a measurement of the percent of words in a particular work which takes the form of acronyms can be used to determine the implicit worth of that work. Clearly, the greater the number of acronyms the greater the intellectual value of the material since, obviously, the last thing anyone engaged in communicating would wish to do would be to deny a portion of the audience the message being conveyed. Thus, in view of their widespread use, acronyms must be concluded to be a valuable contributor to the worth of most material.

Figure 25 examines this premise and presents for a number of important acquisition documents the actual acronym use-factor, called the "acronym activity index" (AAI), measured in the fundamental unit called a "GLOP" (itself, not surprisingly, an acronym for "groups of letters for obfuscating points"). The success achieved in the bountiful use of acronyms in these documents is evident from the enviable ratings shown. These ratings are particularly creditable when contrasted with those of the more acronymically impoverished examples from other writings which are also included at the bottom of the scale. Clearly, communication in the

FIGURE 25
Use of Acronyms in Aiding Communication



material acquisition arena has risen to a very high plateau. In fact, a newly prepared government document has a list of 10,000 official abbreviations to be used in specifications alone. Approximately, the document is referred to as "DOD STD-12."

Law Number XX, the Comprehensive Law of Incomprehensibility, derived from evidence such as that just discussed, can be stated:

> XX: **Profound concepts are often characterized by their difficulty of being understood; therefore, persons unfamiliar with Greek or Latin should give intellectual depth to their ideas by utilizing acronyms to a degree more or less proportionate with the lack of sophistication of the ideas being presented.**

There are still further advantages to acronymical "anonymity." For example, it may seem quite sensible for a radar designer to point out that HF and UHF are simply too low frequencies to be of much interest for target-tracking applications. However, to state that "high frequency and ultra-high frequency are too *low* fre-

quencies to be of much interest for target-tracking applications" would suggest the speaker must be suffering from some form of semantic delirium. Such is the advantage of being obscure clearly.

The current trend toward ever-greater proliferation of acronyms does, however, introduce a spectre of danger: the potential advent of an *acronym gap*.

The Defense Marketing Survey has stated that in carrying out its services it has compiled a list of over one million acronyms which are in common usage in defense matters. These consist principally of "words" made up of five or fewer letters. Since the number of possible five-letter (or less) acronyms that can be formed with the English alphabet is no more than about 14 million, it can be seen that nearly 10 percent of all possible reasonable acronyms have already been used up. With the accelerating use of such nomenclature, the day when the creation of new systems will no longer be possible thus may not be too distant. This, of course, portends ill since the Soviet Union enjoys a position of inherent acronymical superiority over the United States owing to its possession of an alphabet containing 32 letters. Some form of accommodation with China and its enormous language population of 14,000 characters would therefore appear to be prudent.

Still another possible solution to the acronymical gap would, of course, be to adopt even longer and less pronounceable letter groupings—an arena in which the U.S. Navy has been in the forefront for some time. One necessarily wonders, however, the impact even today on an organization's or individual's self-esteem to be known as the NAVHLTHRSCHEN, the NAVDISTCOMDTS, COMNAVOCEANCOM, or the NAVMEDRSCHU. On the other hand, this identity might not appear all that unattractive to individuals assigned to such organizations as ARF, ARG, NEMISIS, DRAG, MORASS, or AWFL[5] (pronounced "awful"), but would represent a considerable come-down to the Chief of Naval Air Training, CNATRA, better known simply as "Sinatra."

Many acronyms do not mean what the inexperienced observer might suspect . . . ANTS, GNATS, DOG, FROG, COD, APE, RAT, BAT, RAM, and CLAM have nothing whatsoever to do with the animal kingdom or Noah's Ark. Rather, they stand for airborne night television system, general noise and tonal system, Development Objectives Guide, free-rocket over ground, carrier on-deck delivery, advanced production engineering, ram air turbine, ballistic aerial

5. Aerospace Recovery Facility, Amphibious Readiness Group, Naval Ship Missile System Engineering Center, (Nuclear) Design Review and Approval Group, Modern Ramjet System Synthesis, Air Force Weapons Laboratory.

target, reliability and maintainability, and chemical low altitude missile, respectively.[6]

In the evolution of an acronym, letter combinations which defy pronunciation are simply reconfigured. Thus, National Emergency Airborne Command Post, NEACP, becomes the "Knee Cap"; the Combat Developments Objective Guide becomes the "Sea Dog"; the Nuclear Weapons Development Guide becomes the "New Dog"; the airborne laser illuminator, ranger, and tracking system becomes "Alley Rats"; and the radar target scatterer becomes the "Rat Scat."

The next anthropological stage in the development of an acronym takes place when verbal representations of a set of letters are converted back into a written form, a stage in which, inexplicably, the resulting acronym is often totally different from the one which started out! Thus, the fixed special surveillance (radar) known as the FSS-7 becomes, when rewritten, the "Fuzzy Seven." Or the electrical unit, the Pico-Farad, is abbreviated PF, which, after phonetic transliteration, is itself often de-breviated "Puff." The ultimate state of maturity of an acronym occurs when it is finally written in lower case and everyone forgets that it is in fact an acronym, such as "radar" and "laser."

Actually, those working on aerospace and other national security matters can make no particular claim to superiority in the acronymical arena. Regulators in all areas have excelled in the exploration of this powerful means of increasing confusion among the masses. Consider the world of federal finance, where the unpronounceable "FNMA" simply becomes a Fannie Mae—closely related, it is said, to a Freddie Mac. Still other mortgage instruments closely parallel in terminology some of the expressions already discussed pertaining to defense matters, such as SAMs, RAMs, FLIPs, and ARMs. Most ominous in the world of mortgages is something called a GPAM, occasionally pronounced "Gyp 'em."

But amid all this confusion is to be found redeeming virtue: Countless numbers of Russian cryptanalysts must surely be fruitlessly engaged in trying to understand what American managers are talking about.[7] Consider, for example, the dilemma of a Russian cryptanalyst confronted with the task of reporting to his superior a passage dealing with topics such as the computer language: "Jules

6. The author experienced the type of problems which can arise from such double meanings on the very first day of a recent tour in the Pentagon. While faithfully carrying out an assigned appointment schedule on Capitol Hill in preparation for a forthcoming confirmation hearing, the author felt it rather inappropriate that typed after the name of several senators on his calendar was the notation "OLD SOB." It was only some time later that it was learned that "OLD SOB" can, in Washington, also mean "Old Senate Office Building." Nonetheless, the ambiguity, in several instances, lingers to this very day.

7. Just as are many American managers.

own version of the international algebraic language, seismic instrusion detection systems, clear air turbulence, multiple independently targetable re-entry vehicles, modular electronic warfare simulators, modular electro-optical warfare simulators, high altitude particle physics experiments, beacon-only bombing systems, Develpment Objectives Guides, surface-to-air missile (systems), battlefield area reconnaissance systems, weather observing and forecasting systems, hostile weapons locating systems, submarine anomaly detection, tactical air-defense computerized operational simulators, biological aerosol detection, automatic test equipment, anti-radiation missiles, tables of organization and equipment, mutual assured destruction, built-in test, inertial navigation, high altitude transmission experiment, and directional attack mines."

Such a report by a Soviet analyst might sound something like:

JOVIAL SIDS CAT, MIRV, MEWS, and MEOWS.
HAPPE BOBS DOG, SAM, BARCS, WOFS, AND HOWLS.
SAD SAMS TACOS, BAD MIRV ATE.
MIRVS ARM AND TOE, MAD SAM BIT IN HATE.
. . . DAM!

In summary, simply stated, it is sagacious to eschew obfuscation.

Costing Enough to be Useful

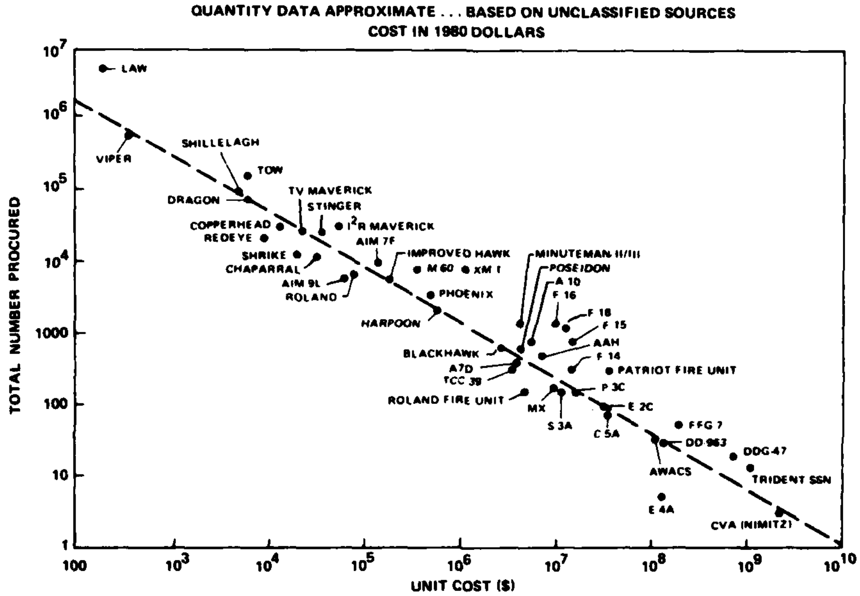
> Live within your income
> Even if you have to borrow to do it.
> —Josh Billings

Law Number XXI explains the empirically observed relationship between the cost of an item and the quantity of that item which is purchased; or, as tennis pro Ilie Nastase noted in explaining his failure to report the loss of his wife's credit card, "Whoever has it is spending less than she was."

Figure 26 shows the rather unexpected relationship which exists between the quantity of an item which is purchased and the cost per unit of that item. It is seen that most articles fall along a constant trend line which encompasses equipment spanning from the $100-per-copy LAW antitank rocket to the multibillion-dollar aircraft carrier *Nimitz*. Why this should be the case may help explain some underlying difficulties in the material acquisition process.

One obvious explanation is that the quantity of an item which can be afforded depends on the cost of the item, and the number procured is a simple consequence of that one fact. This seems to be a rather unsatisfactory interpretation, however, since it implies that there are no unique requirements for larger or smaller quantities of various types of equipment; one merely buys few of an item because it happens to be more costly or many because it happens to be less costly, independent of what the item may be intended to do or of the need for that item.

FIGURE 26
Cost-Quantity Trade-offs in Military Hardware



In this regard it is interesting to note that there exists a maximum acceptable unit price, $10^{10}/N^{1.2}$ for *any* individual item of equipment, and this price depends only on the quantity, N, of that item to be purchased. Once the quantity has been determined, the striking conclusion is that the cost of all items gravitates to this maximum. Additional capabilities somehow creep into the hardware until the unit cost approximates the above-mentioned value, which is known as the "threshold of tolerance."

Thus, any item of which only a few are needed can (and will) be allowed to take on additional features until the cost rises to the vicinity of the limit described. Bert Fowler, Vice President of the MITRE Corporation and former Deputy Director for Defense Research and Engineering, has pointed out that for some reason a mess table on a nuclear submarine costs substantially more than a mess table on a conventional submarine. Similarly, a clock in a Mercedes Benz costs a great deal more than a clock in a Volkswagen. So it goes with each component until the capability and cost of the entire system rise to the threshold of intolerance as described in the Law of Conservation of Input.

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In those early days, however, the pressure toward more capable and more costly designs was already at work. Professor Wood notes in passing that "the Curtis-Wright, Jr. airplane was designed to the following simple specifications, listed in order of importance: (1) low first cost, (2) safety, (3) appearance and performance. Professor Wood goes on to explain that "the actual first cost achieved in building this airplane (about $1,400 retail in 1930) was considered at the time to be exceptionally low, though the safety record was not quite so satisfactory, and the sacrifice of performance (cruising speed of about 65 mph) turned out to be so excessive that the airplane found little use as a means of transportation in competition with the automobile."

The seeds of increasing expectations were sown at an early time.

> **XXI: The features incorporated into any given system will continue to increase until the unit cost of the system in dollars approximates the Threshold of Intolerance, which is defined as $10^{10}/N^{1.2}$, where N is the quantity of the item which is to be purchased.**

This trend toward higher cost is, of course, exacerbated by the fact that the exponent in the denominator above is greater than unity. This means that the high unit cost which is acceptable for low-quantity items more than offsets the volume impact of high-quantity items—so that a contractor does slightly more business by dealing in high-cost/low-volume materiel. Similarly, program managers of high-unit-cost items will be able to enjoy the status of directing larger overall enterprises than their counterparts dealing in more economical systems, albeit procured in larger volume.

On the other hand, an approximation to Law XXI is that the quantity of an item procured multiplied by its unit cost always equals 10^{10} dollars. This provides a convenient method of determining the total procurement quantity for most programs.

Over the years others have studied various effects related to the one noted herein. Al Flax, President of the Institute for Defense Analyses and former Assistant Secretary of the Air Force, has pointed out one such interesting investigation described in the 1939 edition of *Airplane Design*. In that book, K. D. Wood addressed the relationship between the quantity of various types of aircraft which were purchased and the price of those aircraft. A principal difference in the observations of Professor Wood and the present data is, sadly, that the most expensive aircraft in the former study cost less than $5,000!

All Started by a Spark

> Nearly all men die of their remedies, and not of their illnesses.
> —Moliere

General of the Army Omar N. Bradley often and with his usual perceptivity quoted the old Signal Corps maxim that Congress makes a general, but only communications can make him a commander. In our zeal to emulate this truism, however, we have somehow managed to place ourselves in so extreme a position that it has sometimes been suggested that the side that wins the next war will be the one with the last antenna standing. As Bob Everett, President of the MITRE Corporation, has warned us with no inconsiderable amount of concern, there are those who would have us believe:

> The American Soldier,
> His strength is as the strength of ten,
> 'Cause he has LSI.

LSI, large-scale integration of electronic circuitry, is indeed important. But one suspects such intangibles as courage, motivation, and initiative may still be worth more than their weight in silicon.

Nonetheless, *The Washington Star* reported that "if past wars were won or lost in places like the playing fields of Eton, future wars will be won or lost on computer terminals." The magnitude of the computer explosion has been illustrated in a recent session at M.I.T. where Michael Dertavzos noted that in the next few decades it will be feasible to store the world's knowledge in a computer for about half a billion dollars per LOC. But, in this case, an "LOC" is not the pedestrian "line of code," but rather, is a "Library of Congress." Needless to say, this is a potential that cannot be overlooked, either.

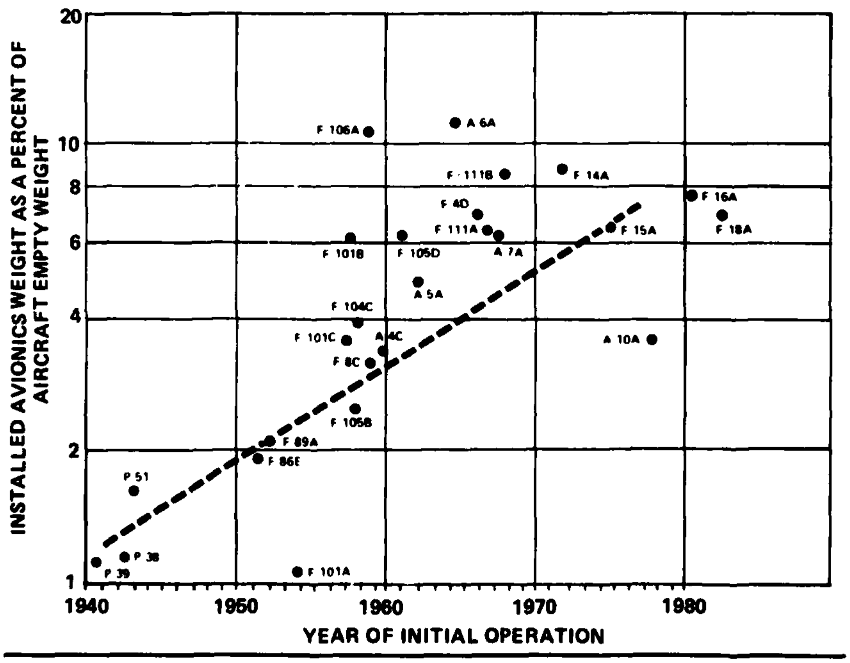
Such viewpoints do point to a trend in the proliferation of electronics which would be either productive or counterproductive, depending on how they are harnessed. The notion of computers fighting one another is *already* a reality. Much has been written about giant data processors developing codes to protect the secrecy of messages while enemy computers simultaneously seek to decipher those codes. Or, on a smaller scale, there are today computers controlling countermeasures devices in electronic warfare operations and enemy computers managing the enemy's counter-countermeasures equipment, and friendly computrs assigning counter-counter-measures, and. . . .

Each application of electronics thus seemingly leads to still another in an almost endless chain, raising the danger that electronics may indeed dominate all equipment before it can itself be controlled. Giant computers are at work design-

ing their own offspring—the ultimate in electronic perpetuation. The extent of this prolific trend is examined in Figure 27, which represents the fraction of military fighter/interceptor/attack aircraft weight attributed to electronics. It has been observed that airplanes are merely a form of truck in which to carry electrons around the sky. Further, the trend with time is, unfortunately, unmistakable. Extrapolating once again, undauntedly, certain characteristics of that sole airplane which was proved in a prior law (Law VIII) to exist a few decades from now can be derived. Namely, it will be made entirely of electronics.

As dubious as it may seem, in order to sustain the above well-established trend, airplanes will eventually have to be built using black boxes in place of pilots and shooting streams of electrons or photons; this since there will be no space available for either pilots or bullets. In this space-age airplane, travel beyond the atmosphere may even be possible; but since there will be no room for

FIGURE 27
Trends in Avionics Aboard Fighter/Attack Aircraft



conventional engines, some form of electrical propulsion will presumably be demanded to give the electron its due. This has, clearly, the makings of science fiction, but the trend toward ever-increasing electronic content of aircraft does seem to deserve a skeptical re-examination. The Law of Unrelenting Electrification unabashedly predicts that:

> **XXII: The contribution to aviation is so great that by the year 2015 there will be no further airplane crashes. Unfortunately, there will be no further takeoffs either: Avionics will then occupy 100 percent of every airplane's weight.**

Only now, with the establishment of this law, can it be explained what Lord Kelvin, who did so much to advance modern science, had in mind when he predicted more boldly than wisely that "aircraft flight is impossible!" All those snickers over the years can be seen to have been undeserved; he, like Calvin Coolidge, was ahead of his time. But the law stated herein would certainly indicate that it was also not his finest hour when he predicted, "Radio has no future!" There can be little question that, as the Chinese proverb states, "It is difficult to prophesize, especially about the future."

It is clear that when Law XXII is fully realized, there will be no space or weight remaining on combat airplanes to carry weapons with which to attack the target. But even this may not be altogether inappropriate. With the high cost of modern air-to-ground weapons, it may prove cheaper to simply innundate the enemy with the avionics pods that will be filling most of the stores-stations anyway.

A related circumstance actually occurred during World War I when the German Air Force, seeking to draw fire away from its bases, began constructing a false airstrip occupied onlv by wooden airplanes, wooden vehicles, and wooden buildings. Unable to draw the attention of the Royal Air Force, the Germans continued to expand and improve upon the deception until finally, having spent nearly as much money as would have been required to construct a legitimate air base, they abandoned the effort in frustration. The extent of frustration was not, however, to become evident until a few days later when a lone British aircraft flew down the main runway and dropped a single *wooden* bomb!

It may be that the trend toward filling all available space *within* an airplane with electronics will eventually necessitate a return to the early days of aviation when the electronics were actually trailed on a line *behind* the aircraft. According to the 1919 edition of *U.S. Army Aircraft Production Facts*, "airplane radio antenna for telegraph work consisted of about 300 feet of fine braided copper wire trailing below and behind the plane from a suitable reel and held in place by a lead weight of approximately 1¼ pounds attached to its end." Unfortunately, with today's emphasis on low-altitude military flying, it is doubtful that the envi-

ronmental impact of such a concept would be acceptable. Even in 1919, the practicability of such a scheme suffered some doubt in that it was duly noted: "Mr. McCurdy, the pilot, had to pay so much attention to flying his machine that he could send only detached letters of the alphabet."

In fairness, it should be noted that, as pointed out by Dr. George Heilmeier, a former Director of the Defense Advanced Research Projects Agency and currently Vice President of Texas Instruments, "If the automotive industry had progressed during the last two decades at the same rate as the semiconductor industry, a Rolls Royce would today cost only three dollars, and there would be no parking problem because each automobile would be one-quarter inch on a side!"

But, at the same time, there remain those cynics of the role of electronics who would point to instances in the space program where had a human not been on board there would have been no one available to repair the failures encountered in the life-support system.

There are also those who might irreverently note that if it were not for the radar display screens in cockpits, there would be no place to affix all the caution and warning stickers. The rampant use of computers is such that there are now those who refer to an airplane and its associated engines as "peripherals."

This trend is nowhere better represented than in the case of the manned bomber. The World War II B-29 contained about 10,000 electronic component parts, the B-47 approximately 20,000, the B-52 50,000 and the B-58 nearly 100,000 . . . or a factor of two each generation. But this rate of growth has been eclipsed by the B-1, which is packed with microcircuits containing as many active elements on a single chip as were carried in an entire B-58. Dr. Allen Puckett, Chairman of the Board of Hughes Aircraft Company, comments—not too seriously—that "the real miracle of the Wright brothers flight was that they accomplished it without the use of any electronics at all." He explains, "The only electrical devices in the *Wright Flyer* were the magneto and the spark gap in each cylinder of the engine." Today, an International L-1011 contains $4 million of avionics, which was roughly the worth of a DC-7C some 20 years earlier. In fact, about $1 million in 1960 would have bought every microcircuit then in existence.

Not only have airplanes succumbed to the electrifying experience of embracing high technology, but so too have the missiles they shoot. The Phoenix missile, for example, contains 538,000 active circuit elements, contrasting markediy with its forebear of a dozen years earlier which suffered through its existence on a mere 118 active elements. Fortunately, great strides have been made in increasing the reliability of electronic circuitry; however, correspondingly great discipline must now be exercised not to negate this gain by the unbounded introduction of more and more circuits.

Bit by Bit

We look at it and do not see it.
—Lao-tzu, sixth century B.C.

This law addresses one of the most ethereal substances to challenge technical managers in many years, a substance that seemingly creeps into systems to an ever-increasing extent, even in instances wherein its very need may be in doubt. It is somewhat as Mark Twain has noted, "Banks will lend you money, if you can prove you don't need it."

Considerable strain can be seen to be building within the acquisition process as engineers and managers seek to produce useful products while complying with the plethora of laws that have come into existence, both natural and man-made. Indeed, laws, like regulations, seem to grow like weeds (See Law XV). Complicating the effort to comply with all the regulations is the often contradictory guidance given by official bodies, such as the various committees of Congress. In fact, in several recent instances the Congress has gone so far as to *legislate* the initial deployment dates for new systems as part of the Appropriations Act. In doing so the dates are *law*. It is not yet clear what the exact liability may be for managers of those programs should they fail to meet the prescribed dates—especially in instances where the Congress subsequently cut their budgets—but it *is* clear that this has not significantly reduced the stress within the acquisition process.

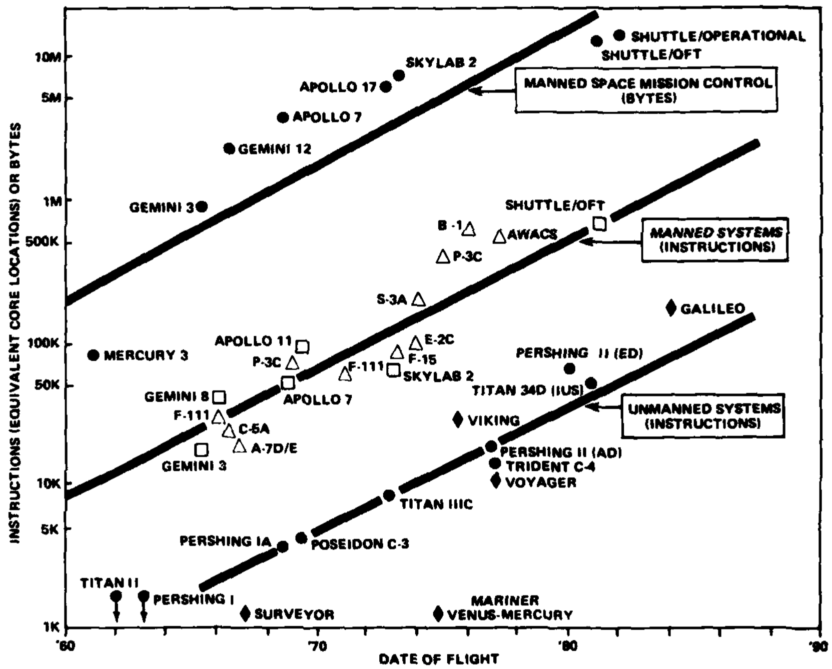
The dilemma faced by those involved in the acquisition process can be typified by the difficulty of complying with both Law Number VIII and the law discussed in the previous section, Law XXII, simultaneously. The first of these laws ordains that the cost of hardware (e.g., airplanes) increases rapidly with time. To comply with this stringent requirement in the time period when there will be no additional space or weight left in an airplane (since the entire volume will, according to Law XXII, be filled with electronics) places severe demands on a designer. Optimally, what is needed is something that can be added to airplanes and other systems which weighs nothing, yet is very costly, and violates none of the physical laws of the universe, such as the law of gravitation or the laws of thermodynamics.

This might appear to be an insurmountable challenge; however, as a result of the traditional ingenuity characteristic of system designers, it can be reported with confidence that such an ingredient has already been found.

It is called—software.

A principal property of software, the phantom of modern technology, can be seen in Figure 28, which illustrates the trend toward ever-increasing quantities of

FIGURE 28
Trends in Software Growth



SOURCE OF MANNED AIRCRAFT DATA: BARRY BOEHM

software in any given family of systems.[8]

There are, in fact, three separate growth modes evidenced by software. The first two of these are from generation-to-generation of new items of equipment (from an F-4 aircraft to an F-14) and from version-to-version of a given item of equipment (Titan I to Titan II to Titan III). The third growth mode, an internal growth mode, reflects the increase in quantity of software from the time the given

8. The groupings of the data shown in Figure 28 into the categories of unmanned and manned systems is interesting, but is most likely a figment of the rather modest data base available with which to treat this topic, although there can be little doubt of the reality of the growth trend within a given class.

job is initially scoped until it has actually been completed. This is often the most exasperating mode of software growth. It has been accurately stated that if you automate a mess, you get an automated mess. Figure 28 addresses the former two modes and suggests a growth rate on the order of a factor of 10 every 10 years.[9]

Law Number XXIII, the Law of the Piranha Principle, is derived from evidence such as that shown in Figure 28, with a strong degree of the encouragement from empirical evidence on the internal mode of growth, and is stated as follows:

XXIII: Software is like entropy. It is difficult to grasp, weighs nothing, and obeys the Second Law of Thermodynamics; i.e., it always increases.

Large-scale use of software can probably be traced back to the SAGE (semi-automatic ground environment) air defense system of the late 1950s, which was implemented using computers comprising 58,000 vacuum tubes and consuming 1.5 megawatts of power. The real-time operating program for this computer contained about 100,000 instructions (backed by support programs of 112 *million* instructions). A subsequent ballistic missile defense system, Safeguard, contained 2.2 million instructions, of which 735,000 were real time, illustrating, once again, the growth propensity inherent to software. There are those who would suggest that the contribution of such degrees of complexity will be excelled only by the projected advent of the WOM, the write-only-memory.

Various studies have been conducted which suggest that over the last 25 years the hardware/software portions of the cost of major systems are shifting from an initial 80/20 hardware/software ratio to a ratio approaching 20/80 in the decade ahead. It can be safely reported that the problems encountered in development programs have managed to stay abreast of this trend.

Actually, software exhibits many of the same properties as hardware. It is subject to human error (typically one error per 100 source lines of code), "reliability" problems, and high penalties for failure to discover problems early in the development effort. Barry Boehm of TRW has collected data which show the cost of correcting software errors at various points in a development activity relative to the cost incurred if the error is discovered in the coding phase. The cost is a factor of 5 greater when not discovered until the acceptance test phase and a factor of 15 greater when uncovered in the operational phase. It is left to Weinberg's Second Law to observe that if builders built buildings the way programmers write programs, then the first woodpecker that came along would destroy civilization!

9. The author is indebted to Stephen L. Copps for his assistance in collecting the data presented in Figure 28.

A classic example of the perversity of software was encountered in the Mariner program when on the Mariner 1 flight the lack of a single dash over a symbol in a little-used routine (the guidance module for failed doppler radar) resulted in a multimillion-dollar spacecraft striking out on its own to explore the distant universe instead of observing Venus as its human masters had intended. But if software is perverse, it is not without some redeeming virtues. The next Mariner flight was saved when the same set of equations (with the dash safely in place) managed to keep Mariner 2 on target in spite of an uncontrollable roll in the launch vehicle which caused loss of ground contact 75 miles before full lock was re-established.

But if the state-of-the-art in managing software development is in some respects primitive, the acronymical language used to cloud the art from those managers necessarily thrust onto the periphery of such activity has reached a high degree of maturity indeed. This language is laced with a veritable core-dump of bauds, bits, and bytes, MIPS, MOPS, and BOPS. In fact, the highest order of acronymical language thus far in use appears to have been created by software specialists working on command and control systems—thus effectively thwarting all those senior executives who may have had the audacity to think it was *their* role to command, or perhaps even to control. But the unquestioned greatest semantical contribution of the software art is the term originally coined to describe one million floating point operations but which can be seen herein to have much broader applicability in describing entire programs—or even entire groups of programs—i.e., the "megaflop." ||

91 Developing a Management Philosophy

Dr. Jules J. Bellaschi

The management of defense systems acquisition programs takes place at several organizational levels within the Department of Defense. These extend from the functional manager to the program/project manager with one project, to the manager with multiple projects, to the general manager responsible not only for many projects, but also for functional organizations and, possibly, field resources.

The manager at each of these levels must deal with the problems and operational elements peculiar to his specific organization. There is, however, a common thread that unites all these organizational levels—the requirement for an overall management philosophy that can be adapted to a variety of organizational structures.

This paper draws upon my research and experience in line and staff positions in both private industry and the Department of Navy over a period of 24 years. My observations have been that one important success factor for managers in industrial-type activities is the existence of a framework for the development of an integrated and consistent approach to leading and managing. The purpose of this paper is to present a structure for the development of such a framework, which is sometimes referred to as "style." This framework is fundamental to government defense system acquisition managers, not only in terms of their own organizational responsibilities, but also to help them understand the many other organizations with which they relate (both government and private) and upon which their success depends.

Management Process and Philosophy

The term "management" is far from having a standard definition. For our purposes, we may define it as a process of getting things done through people operating in organized groups. Management as a process is capable of being analyzed as an array of interrelated and interdependent actions. This array includes the management functions of planning, organizing, executing, and controlling.

Planning is the creative, decision-making function by which the semipermanent operating framework of policies and objectives are established and by which operating plans (long and short term) are also established. Through the

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organization function (which includes staffing) materials, human capabilities, and information flow are architecturally brought together. The *mechanics* of management consist of planning and organizing. The *dynamics* of management consist of executing and controlling. By *executing* we mean to direct and coordinate the static organization and create values consistent with the adopted policies, objectives, and plans. The *controlling* function (judicial) points out problem areas detrimental to effective performance. An important function of the manager is to integrate the mechanics (planning and organizing) and dynamics (executing and controlling) of management and face individual problems in terms of their relationship to other problems.

The management process thus developed must be tempered by the manager's philosophy, which might be categorized as judgment, exception, adaptation, and influence. If the manager relies only on judgment, each operating problem is solved separately as it occurs (fire fighting). A manager utilizing exception interferes only if some control variable is exceeded. With an adaptation philosophy, the results and environment are continuously evaluated and projected, the decisions are based on the forecast. In using an influencing philosophy, the manager views his organization as an organism that both is influenced by and influences the environment in which it operates. These four management philosophies are not exclusive, but can be utilized in combinations by a manager.

Each manager must structure his own management process and philosophy. The personal management process and philosophy provides both a foundation in one's practice of management and an intelligent and integrated approach to the solution of problems. The development by an individual of a management process and philosophy cannot be completed, since management is dynamic and has no beginning or ending. Such development must be a continuous and evolving endeavor.

Decision-making Process

The planning function rests almost entirely on the making of decisions. Decision-making is the thinking process that leads to the recognition and definition of a problem, the logical determination of a means of solving the problem, and the selection of a specific course of action. A problem exists when there is a lack of something desirable, or when something undesirable is present or will be present in the predictable future. The desirability or undesirability of a condition or event is based on our philosophy, our past decisions, and our objectives. Each manager has his own decision-making process. It is essential that he understand it, revise it if necessary, or build further on it.

Decisions, thus planning, are devisible into three categories:

1. Strategic decisions determine the long-term policies, objectives, and plans. Because of the tremendous impact strategic decisions have on an organization's future position, this is the most important of the three categories. Usually strategic decision-making is difficult and requires a long period of study and concentration.

2. Tactical decisions determine short-term objectives, policies, and plans.

3. Operational decisions determine what should be done next when performing a task.

The scarcest resource of the manager is time. The manager, based on his risk-taking philosophy with respect to delegation, and his long perspective must determine how much time he personally needs to spend in decision-making in each category and how much time to spend on individual decisions. This determination will establish the level of decentralization of decision-making in an organization.

The steps in the decision-making process, although difficult to describe, can be perceived as follows:

Step 1: Becoming aware of and initially defining the problem. This can be brought about by observing, reading, listening, and analyzing, as well as through imagination and information feedback.

Step 2: Stage of confusion in which the problem is more clearly defined and isolated, and it is determined whether the problem requires a solution and when.

Step 3: Defining the problem in detail to the extent required.

Step 4: Proposing alternative solutions. An effective problem solution system entails creative thinking which, in turn, requires the establishment of an environment that nurtures creativity. One's psychological nature may inhibit creativity, for instance, because of a low tolerance for risk-taking and ambiguity. The culture pattern might be one which prefers tradition to change or the leadership style may inhibit participation.

Step 5: Comparing alternatives and making a selection. The choice of alternatives must consider the probable acceptance by those responsible for solution execution and the related level of authority required.

In conceptualizing the decision-making process, the manager must consider the extent to which collaboration with others is needed, the need for verification before and during execution, and the timing of the making of the final decision and its execution. The speed factor can be important, and there can be a fine line between being impetuous and procrastinating in resolving problems. It takes a deep understanding of the situation and of one's own style to determine if one is being impetuous or procrastinating.

Information System

Managers spend extensive time in gathering data—reading, listening, looking and transcribing. Much of the data gathered is never used, thus never becoming real information. The challenge to the manager is to decrease the accumulation of data that never becomes information.

An information system is divisible into: (1) input (data), (2) processing and storage, and (3) output (information). It is important that a manager establish his real information requirements for the following activities: (1) routine operations, (2) historical records, (3) planning, and (4) control, all before developing an information system.

The manager uses both formal and informal information systems. The formal are those systematically operated by an organization. The informal, which are as important as the formal, depend upon both the internal and external relationships the manager has developed. One of the imporant jobs of the manager is to communicate to others in the organization the data he acquired through the informal system that they may use as information. The program manager must develop within his management approach the process of continuously re-evaluating and developing both the formal and informal information systems.

Planning and Control System

Managers develop individualized planning and control systems. Planning is essentially a commitment. Control determines whether the commitment is being met and, if needed, initiates changes in plans or the execution process. The planning and control system might be thought of as a continuous process of establishing plans by one's decision process and information system. Then, through control, adjustments are made, if necessary, to the plans or execution process by again utilizing the decision process and information system.

Some of the important concepts that managers should consider in analyzing and developing their planning and control systems are adaptation, integration, information feedback, decision rules, and risk-taking thresholds.

Adaptation is the coping mechanism by which modifications are made as needed to plans and the execution process. Lessons learned are an important aspect of the adaptive process. *Integration* refers to the unification of the various parts of the planning and control system. *Information feedback*, if not properly utilized, can put the manager in a reactive mode. This can be the result either of using antiquated information, or the long lead time between decision-making and implementation of plans that causes corrective action to take place too late.

Decisions often result from the application of *decision rules*. If for a specific problem we have a decision rule, the decision is programmed. Decision rules are

programmed if they are repetitive, and procedures have been worked out for handling them so that they don't have to be treated as separate problems each time they occur. Programmed decisions should be considered for automation. Decisions are not programmed when the problem is non-routine and there are no established decision rules for determining the course of action to take. *Risk taking* is an important aspect of decision rules since decision rules are usually made under conditions of risk. The question of risk-taking concerns the cost of being wrong, the payoff of being right, the judgmental probability of the cost and payoff occurring, and the manager's risk-taking threshold.

The manager should personally structure his planning and control system to be a mix of formalization and non-formalization. It is important that in developing the planning and control system a conscious approach be taken to blend its formalization and non-formalization, and that consideration be given to the concepts of adaptation, integration, information feedback, decision rules, and risk-taking thresholds.

Organizing

The development of the organization and its staff is one of the most important functions of the manager. Organizational development is the process of logically grouping activities, delineating and delegating authority and responsibility, and establishing working relationships that will enable both the organization and its members to realize their mutual objectives. A healthy organization is an adaptive, common-goal-seeking, problem-solving organism that is integrating and coordinating the efforts of individuals and subgroups such that working at cross-purposes is minimized. A useful concept of the organization is that of a system of interlocking subgroups with the connections provided by individuals who are members of more than one of the subgroups. Often an organization has the problem of lopsided growth in that there has not been the same degree of growth of capability of the various units throughout the organization. Such lopsided growth must be attended to by the manager who is constantly attempting to integrate all subunits of the organization. Organizations work best if their parts are in good communication with one other and are committed to the goals of the organization. The most that an organization can do is bring out the best in its people.

The first step in organizational analysis is to identify the customer. The next step is to analyze the process by which the organization uses resources to provide the product or service to the customer. This is the production function by which the organization converts resources (including the time and capabilities of the people) into output. There are certain concepts which should be considered in the

analysis of the process by which an organization produces products or services. First, there is the concept of optimum utilization of the total organization and subgroups. It is rarely possible to have optimum utilization of all subgroups in an organization. Thus, resource allocation is an important function of the manager. The second concept is that of the experience curve concerning the organization. The learning curves of the individuals in the organization are significant, of course, but more important are the organizational improvements by the subgroups and the total organization that are brought about through the learning curve. That is why it is unwise to continuously reorganize. A new organization has a burn-in time, a time of improving itself. Yet, there is a need for innovation and change. The challenge to the manager is to find the right mix of continuity and change in the organization.

The third concept is that of decentralization. The manager must decide to what extent self-contained subgroups and individuals will be given the resources, authority, and flexibility to perform their jobs without interference and undue control by those above them. The payoffs of decentralization include improved innovation and productivity throughout the organization, and conservation of the manager's time for those things that require his attention. A manager in a decentralized environment can still retain control through overall performance monitoring.

Achieving greater integration and high morale in an organization not only in volves a rational design of the *formal* organization, but also must consider the communication and social structure of the *informal* organization. The cooperative phenomena take place in both the formal and informal organization, because this is how individuals and groups operate. Individuals and groups, as they work together, develop informal arrangements and patterns. There can be too much concern for the development of the formal organization and the operating procedures, which can stifle initiative and creativity, and not enough concern with the development of communications and relationships brought about by the informal organization. One of the many self-inflicted wounds of the leader is to neglect the informal organization because of the attention given to the formal organization.

One important organizational tool that can be very effective is that of project management. It is applicable if there is a specific objective with milestone dates for completion, and if the task can be accomplished more effectively by a special project team than by the present organization. The project office often is matrixed in that it depends on the present organization for support, and members of the present organization are assigned to the team. The challenge is to develop the proper staffing balance, depending on the task to be accomplished, of self-containment and of matrix support. Successful utilization of projectizing not only

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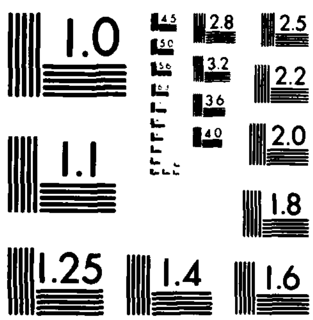

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

requires quick and planned staffing of the project, but also a termination time so that resources can be reallocated. Successful project management requires: (1) a clear definition of the project objective with some type of charter; (2) the selection of a capable project manager who understands how to utilize matrix management, if it will be used; (3) staffing of the team based on an analysis of personnel project requirements on a time basis, and meeting such staffing requirements; (4) the establishment of a plan of action with milestones by the team, with approval by those who set up the team and those to whom the team reports; (5) the establishment of a control mechanism that considers quality, quantity, cost, and time; (6) the delegation of extensive responsibility and authority, with accountability and without extensive outside control; and (7) the physical resources to perform the task.

There are highly formalized and loosely structured organizations, autocratic and participative organizations, goal-oriented and drifting, creative and routine. There are organizations in which people perform only specialized functions, and those in which people perform many functions, and those in which there is job enlargement and enrichment. Based on my experience and research, I believe that organizations that are most efficient and effective are the ones that have the following characteristics: They have order but are not overly rigid; they have high levels of participation by everyone in decision-making and execution, but have strong decisive leadership; they maintain an atmosphere of creativity; they offer a combination of job specialization and job enlargement and enrichment; they are managed by objectives; they have systematized controls that are not overburdensome and wasteful; and they operate through both a formal and informal structure.

There is no one correct type of organization, and managers must formulate their own organizational concepts, styles, and architecture. The type of organization depends on the organizational mission, situation at hand, the culture of the organization, environment, survival status, historical circumstances, leadership assumptions, expectation of the members of the organization and those to whom it reports, and corrective actions required. Managers must formulate their own organizational concepts.

Conclusion

A project manager who wishes to make a serious study of the development of a personal leadership and management framework and conceptualization of the life-cycle process of acquisition must be prepared to adopt a new approach to his job. He must be ready to sacrifice, if necessary, preconceived ideas. Also, he must realize that such a development is evolutionary and continuous throughout one's career in acquisition management and is based on one's experience and learning process. ||

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Managing Human Resources in the '80s

98

David D. Acker

The human resource is the lifeblood of the American economy. How well we develop this resource—each person we employ—will determine not only our continuing capacity for economic growth, but our national welfare as well. At the same time, we cannot afford to offer American workers opportunities for training, education, and development, and then fail to provide them with opportunities to use their enhanced abilities. We cannot afford to have the U.S. work force feel it is not being challenged and motivated to perform at maximum productive levels.

Managers have always been faced with the awesome task of developing and using human resources fully and efficiently, and this task takes on even greater importance as we move into the '80s. Unfortunately, there is no reliable information available on how well this task is being accomplished and whether our human resources are increasing in value. This seems incongruous when one considers that the human resource is the most precious commodity within either a civilian or military organization.

Projecting Human Resource Needs

Considering the value placed on the human asset, the results of a 1980 survey of 334 leading business and industrial organizations are rather surprising (Figure 1). Of the organizations polled, 42 percent project their human resource needs 1 year ahead or less, and only 5 percent project their human resource needs more than 5 years into the future. The survey also indicated that human resource planning is focused on the upper echelons of the work force—executives, engineers, and electronic data processing (EDP) professionals—the people most difficult to recruit (Figure 2).

Van M. Evans, president of Deutsch, Shea & Evans, Inc.—the company that conducted the survey—found that rapid changes in U.S. industry, particularly changes in technology, make it more difficult to project the need for human resources on a long-range basis. These rapid changes have created a requirement for large quantities of technical professionals and skilled workers, as well as for a

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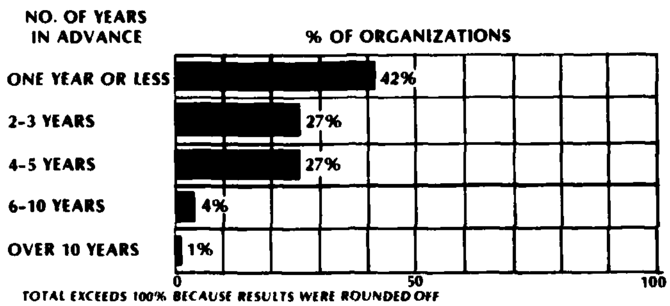
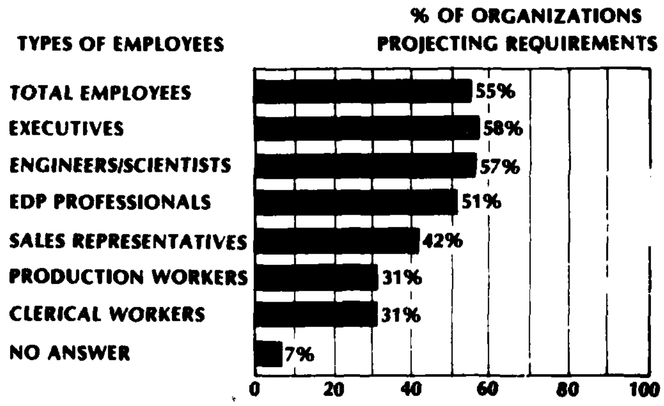
FIGURE 1
Human Resource Projections



SOURCE: DEUTSCH, SHEA & EVANS
SURVEY OF 334 ORGANIZATIONS, 1980

FIGURE 2
Types of Employees for Which Human Resource Projections Are Made



SOURCE: DEUTSCH, SHEA & EVANS
SURVEY OF 334 ORGANIZATIONS, 1980

broad spectrum of specialists. Most of the companies surveyed are not meeting the need. In many fields, companies are hiring talented personnel away from one another in an expensive game of musical chairs. Failure to plan for human resources is one of the elements contributing to our declining productivity, loss of critical skills, and job mismatches.

Human Resource Planning and Development

The basic objective of human resource planning is to match human resource needs with the human resource supply over time in order to satisfy the objectives of the organization. Human resource planning and development considers the selection, training, placement, performance appraisal, job satisfaction, promotion, and retirement of personnel.

Unfortunately, human resource planning and development is complicated today by several factors, principally:

—Managers who are too busy doing other things to give the sufficient attention to human resource planning.

—Skilled workers who do not perform to full capacity.

—Organizations that are unstable, i.e., subject to frequent changes in direction (objectives) or reorganization.

A brief examination of the current status of this activity follows:

—Human resource planning is applied almost exclusively to managerial personnel. In fact, the function of human resources is often assigned to the management development unit in the organization. It has become the procedure by which many organizations seek to ensure a steady supply of replacements for the incumbents of key management positions.

—When human resource planning is extended to all personnel, it is generally viewed as a means to control manpower costs. Emphasis is often placed on reducing staff, inhibiting featherbedding, or eliminating unproductive personnel. Thus, human resource planning serves as a process for developing "manning" tables, establishing work-measurement standards, and determining manpower costs.

—When human resources are treated as commodities, the activities of the organization are translated into financial terms and incorporated into the balance sheet. Because it is difficult to place a price on the value of personnel, human resources are treated by accountants as an expense rather than an asset.

A survey was conducted early this year by Information Science, Inc., (ISI) of more than 2,000 chief executive officers (CEOs) from the nation's largest business and financial organizations.

When asked to list the three most significant personnel problems in their organizations, 65 percent of the CEOs cited human resource planning and development, followed by government regulations (50 percent), and recruitment and selection (35 percent). In addition, 85 percent of the CEOs said that human resource planning and development are current activities, or are in the works; another 6 percent said they are under review.

Chief personnel executives, who were also polled, have a different set of expectations for the personnel function than do CEOs. The chief personnel executives rated human resource planning and development as an important function; however, they gave this function a lower priority than wage and salary administration, benefits work, or compliance with government regulations.

During this decade, human resource planning and development will involve:

—Formulating an inventory of skills needed in each discipline vs. the skills available, and matching the human resource inventory projections against the organization's training and educational capabilities.

—Forecasting human resource needs by function and level, modified by turnover rates, to determine actual needs and the training or education required.

—Planning and conducting (or sponsoring) training and educational programs to reduce human resource deficiencies.

Middle Management Unrest

One of the most important human resources in an organization is middle management. Let's briefly examine the situation at this organizational level.

Today, there is growing unrest at the middle-management level. A recent report provides some clear evidence.[1] According to this report, middle managers are:

—Constrained by growing government regulations.

—Threatened by an eroding power base and an influx into business and industry of bright young employees with master's degrees in business administration.

—Frustrated by managers who turn deaf ears to their problems.

—Boxed in by increasingly specialized and restrictive organization charts.

—Unhappy over their pay.

—Unsure about their futures.

The report is based on data collected over a period of 28 years from more than 240,000 workers in over 400 companies. Past research has shown that, when comparing the attitudes of managers with those of the hourly and clerical

1. Opinion Research Corporation, *Strategic Planning for Human Resources: 1980 and Beyond*, Princeton, N.J., 1980.

workers they supervise, one group perceives gains in its relative well-being; the other group sees these gains as having come at its expense. The Opinion Research report verifies the conclusions of previous research. Today, hourly and clerical employees perceive themselves as being able to exert more influence in the running of their departments; on the other hand, middle managers report that they are losing control.

"Middle-management jobs . . . are more specialized and compartmentalized than ever before," the report notes. It continues, "At one time, management did not have to negotiate with anyone. Now, management must negotiate not only with Labor, but also with Government, not to mention continuous bouts with other constituents." Managers are not enjoying the control and autonomy they once had.

The report also states that middle managers feel they are being reduced to "men who pass problems up though organizational levels, wait for responses, and then pass decisions down through layers of subordinates." In major companies this feeling is partially the result of a growing impersonality resulting from mergers, acquisitions, diversification and a growth of specialized management priorities.

Productivity: A Look at the Past

The continuous objective of manufacturing management is to improve productivity—of human resources, of capital invested, and of materials and machinery. Traditionally, this improvement occurs through more effective use of the resources available and modernization or replacement of existing machinery and facilities with something more efficient. In either case, the ultimate effect is an increase in the productivity of the human resources employed.

At the beginning of the 20th century, pioneers in the scientific management movement—peoplc like Frederick W. Taylor, Frank B. and Lillian M. Gilbreth, and Henry L. Gantt—were interested in the relationship between employees' productivity and financial compensation. They were concerned with how to increase the productivity of the human resources while, at the same time, obtaining a commensurate decrease in human effort and fatigue. These pioneers also devoted considerable attention to the allocation of human resources in production, and the ways in which work is organized and wages are established. Taylor and the Gilbreths discovered ways to increase productivity and wages while reducing employee fatigue. Gantt, through breaking down a project into discrete tasks and logically scheduling those tasks, also contributed to increasing the productivity of human resources.

These early studies of effective utilization of human resources were given considerable attention when World War I began, because of the problems associated with industrial and military mobilization. After that war, studies were made of adjustment of the employee to the job and to the work environment. Beginning in 1927, the studies conducted by G. Elton Mayo (1880–1949) of Harvard, and his associates at the Hawthorne (Illinois) plant of the Western Electric Company, provided the first positive correlation between the employee's productivity and his participation in the decisions that affected him and his work. Following the Hawthorne experiments, the emphasis in human resource studies shifted to the attitudes of the employee toward his job and his company, and to the relations between the employee, his associates, and his supervision.[2]

When World War II began, the focus of human resource studies was placed—as it had been during World War I—on how to best use the limited resources available to achieve the maximum utility. After World War II, there was general unrest during the transition from a wartime to a peacetime economy. Industrial and government leaders recognized labor-management relations to be a crucial factor affecting the success of business enterprise and the development of the U.S. economy. The emphasis in human resource studies shifted to the sociological and psychological aspects of the employee and his job. During this period, Chester I. Barnard (1886–1961), a prominent industrialist, recognized the importance of the informal as well as the formal organizational structure. He reviewed the organization as a social system—one necessitating a high degree of cooperation, as opposed to emphasis upon authority and the giving of orders.[3]

Many individuals have contributed to improved management and productivity of human resources since the late 1950s. Let's review some of those contributions.

Norman R. F. Maier, an industrial psychologist at the University of Michigan, observed the importance of employee participation, group decisions, and motivation to productivity.[4] Rensis Likert (1903–1972), also of the University of Michigan, determined that equating high morale to high productivity is too simple; many combinations are possible. He demonstrated that supportive as opposed to threatening supervision and participation as opposed to "heirarchically-controlled" management, affect productivity in a positive way. In other words, employee-centered, rather than production-centered, attitudes of management

2. Carl Heyel (ed.), *The Encyclopedia of Management*, Litton Educational Publishing, Inc., New York, N.Y., 1973, p. 708.
3. Barnard, Chester I., *The Functions of the Executive*, Harvard University Press, Cambridge, Mass., 1938.
4. Maier, Norman R. F., *Principles of Human Relations*, John Wiley and Sons, New York, N.Y., 1952.

are basic to productivity.[5] Shortly before his death, Likert conducted research into effective supervision and its relationship to effective and productive work groups. He explored four management styles—exploitive-authoritative, benevolent-authoritative, consultative, and participative-group. He concluded that the participative management style is the ideal one for a profit-oriented and human-concerned organization.[6]

Douglas McGregor (1906–1964), professor of industrial management at M.I.T., clarified the direction the new field of organizational behavior should take, saying there are two types of management attitudes: Theory X managers, who believe human beings dislike work, are basically lazy, must be coerced and directed, and want security above all; and Theory Y managers, who hold the opposite view.[7] William Ouchi, professor of management of U.C.L.A., has added a Theory Z. A Theory Z company emphasizes long-range planning, consensus decision-making, and strong, mutual worker-employer loyalty. Such a company, which can be a model for companies struggling with declining productivity and high employee turnover, exist in Japan, and there are a few in the United States—IBM, Proctor and Gamble, Hewlett-Packard, and Intel.[8]

Chris Argyris, who served on the Yale and Harvard faculties, believes that organizations tend to keep their human resources passive, stunting the psychological growth of employees and supressing productivity.[9] One of Argyris' major themes is the dichotomy of individual needs and organizational needs.[10]

Abraham H. Maslow, Brandeis University, studied attempts of industrial organizations to apply behavioral findings to daily business operations. He developed a framework for a hierarchy of needs, suggesting that one of managements' roles is to assist employees in achieving their levels of need; and that the manager's reward is twofold, a more productive organization, and his own maturity.[11]

Frederick Herzberg, Case Western Reserve University department of psychology, was interested in the role that work and working conditions play in the lives of normal working people. According to his "motivation-hygiene"

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5. Likert, Rensis, *New Patterns of Management*, McGraw-Hill, New York, N.Y., 1961.
6. Likert, Rensis, *The Human Organization*, McGraw-Hill, New York, N.Y., 1967.
7. McGregor, Douglas, *The Human Side of Enterprise*, McGraw-Hill, New York, N.Y., 1960.
8. Ouchi, William, *Theory Z*, Addison-Wesley, Reading, Mass., 1981.
9. Argyris, Chris, *Personality and Organization*, Harper and Brothers, New York, N.Y., 1957.
10. Argyris, Chris, *Integrating the Individual and the Organization*, John Wiley and Sons, New York, N.Y., 1964.
11. Maslow, Abraham H., *Eupsychian Management*, Richard D. Irwin, Inc., Homewood, Ill., 1965.

theory, hygiene factors depend on the environment and prevent job dissatisfaction; motivators (satisfiers) derive from the job and increase productivity.[12]

The managerial grid concept, developed by Robert R. Blake and Jane S. Moulton while at the University of Texas, is based on research into the personal behavior of leaders, who are classified according to the degree they are production-oriented or people-oriented. Their research, a logical extension of McGregor's theories, suggests that high production (productivity) can be expected from groups led by people-oriented managers; moreover, the ideal leader devotes attention simultaneously to people and production while concurrently satisfying superiors and subordinates.[13]

Until the last two decades, most American managers were not interested in European or Japanese management and organizational systems. This may be attributed principally to the fact that the United States has been the productivity leader among industrial nations. In recent years, however, both the United States and Europe have been losing their dominance in many different industries. Japanese improvements in productivity, product quality, and management have caused changes in the world's industrial practices.

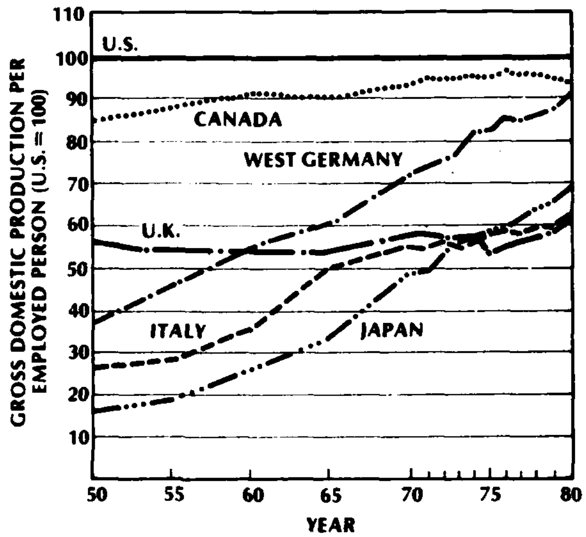
Productivity: A Look at the Present and Future

Today, productivity is one of the most commonly discussed management subjects. The relatively high productivity growth rate in the United States during the 1950s and early 1960s declined in the 1970s, although this country is still ahead of the rest of the world (Figure 3). The Department of Labor's Bureau of Labor Statistics indicates that when comparing the real gross domestic product per employed person—the national measure of productivity—the United Kingdom is 39.5 percent behind the United States, Italy trails by 39.4 percent, Japan by 31.6 percent, West Germany by 11.3 percent, France by 10.6 percent, and Canada and the Netherlands by 8 percent.

Why the concern, then, about low U.S. productivity? Part of the answer is that productivity has two meanings. One concerns human resources, or how hard people are working; the United States looks good on this basis. The other concerns the number of units or the dollar value of the units people are producing per hour; on this basis, the United States does not fare as well. The Bureau of Labor Statistics indicates that gains in U.S. manufacturing productivity slowed from a 2.8 percent-a-year average between 1959 and 1969, to 2.5 percent a year between 1969 and 1979. The gain was 10 percent in 1979, and only 0.5 percent in

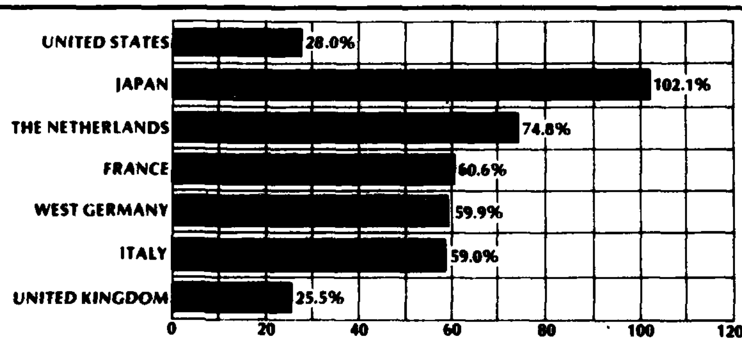
12. Herzberg, Frederick, *Work and the Nature of Man*, World, New York, N.Y., 1966.
13. Blake, R. R., and Moulton, J. S., *The Managerial Grid*, Gulf Publishing, Houston, Texas, 1964.

FIGURE 3
Gross Domestic Production per Employed Person by Nation: 1950 - 1980



SOURCE: BUREAU OF LABOR STATISTICS, 1980.

FIGURE 4
Productivity Increase in Manufacturing, 1970 - 1980



SOURCE: BUREAU OF LABOR STATISTICS, JUNE 1981

1980! The 1970–80 manufacturing productivity increase in Japan and several European countries is shown in Figure 4.

In 1978, the United States Council of Economic Advisors projected a 1.5 percent economic growth rate for the United States over approximately the next 10 years. However, based on the information presented above, that forecast appears to have been overly optimistic. And even if the growth rate in the United States does prove to be 1.5 percent, France will overtake the United States in total worker productivity in 1986, West Germany in 1987, and Japan in 1988. Some other countries will not be far behind (Figure 5).

The trend of the past 2 years indicates that the United States is approaching a zero productivity growth rate. If that continues, and growth rates in France, West Germany, and Japan continue on their predicted courses, those countries could overtake the United States in 1982, 1983, and 1985, respectively.

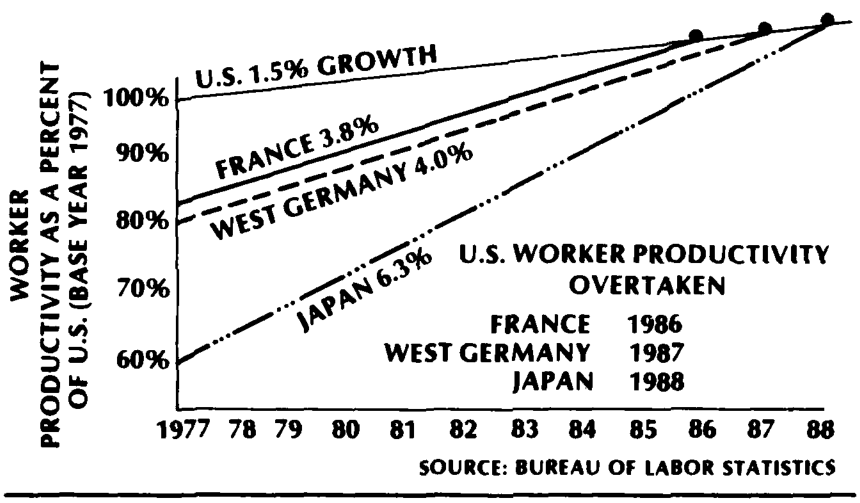
Several reasons can be cited for the poor showing of the United States:

—The large number of new entrants in the job market because of the high post-World War II birthrate, women, and minorities.

—Tax laws that encourage spending instead of saving.

—Lack of investment incentives.

FIGURE 5
Worker Productivity Projections
(Based on Projected Growth Rates - All Industries)



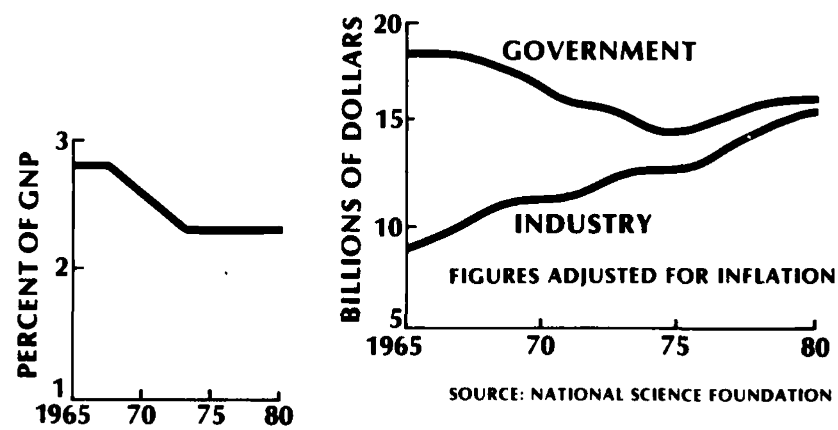
—Inflation, which causes investment uncertainty.
—Short-sighted company management, which is influenced by business schools that advocate the need for short-term gains.
—General decline in the work ethic.
—Union contracts, which tend to ignore productivity.
—Inadequate research and development. The United States is putting less of its wealth into research and development (Figure 6). Japan, by contrast, is subsidizing its private research and development.

Although some of the problems have been addressed by the current administration, their effect on U.S. productivity will not be multiplied overnight.

Today, much of the emphasis on productivity in the United States stems from the increasing competition from foreign products, and the current inability of our manufacturers to counterattack. One way for American industry to revitalize itself and meet this challenge is through management's development and use of the creative potential of the American worker.

According to a recent issue of the newsletter *Productivity*, people are the most essential ingredient in a productivity improvement program.[14] The publisher of

FIGURE 6
Research and Development Spending in the United States

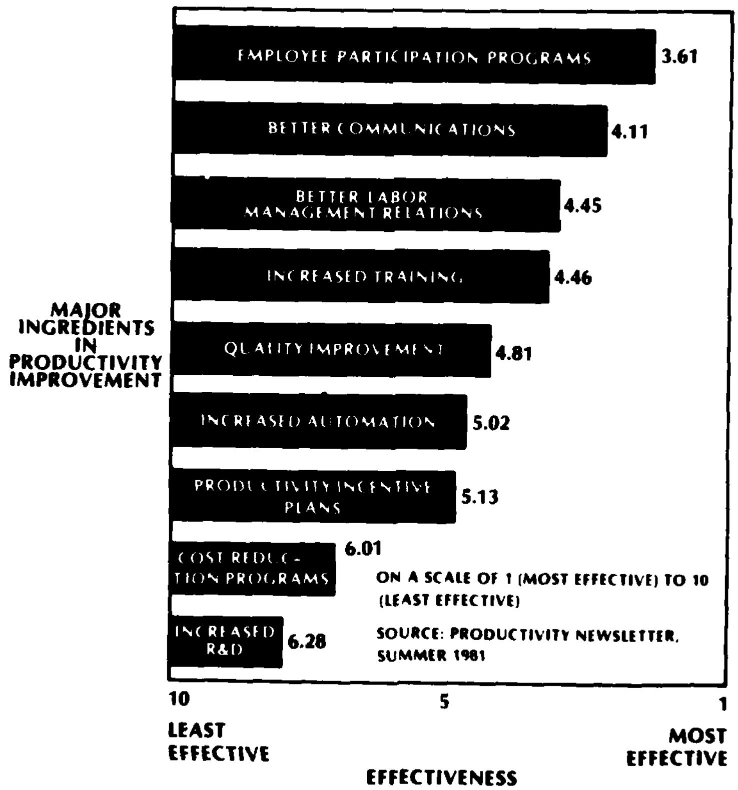


14. Based on data from the "Productivity" newsletter as reported in *Mechanical Engineering*, September 1981.

Productivity, Norman Bodek, reporting on the results of a recent survey, said the most effective way to bolster productivity is through employee-participation programs (Figure 7). Better communications ranks second, followed by improved labor-management relations, increased training, improved quality, and increased automation. More than half of the companies surveyed have some kind of employee-participation programs; 68 percent are planning such programs.

Last year William C. Norris, chairman of Control Data Corporation, stated that "the human element is a crucial factor in American productivity." He believes a computer-based education may be a good way to enhance this

FIGURE 7
Measures of Effectiveness in Improving Productivity



resource, stating that "human resources command priority because there is a rapid trend in the United States from an industrial society to an information society.[15] Plato, Control Data's computer-based educational system, provides work-related training; it allows the disabled and homebound to work from their residences; and it facilitates a variety of personal services, such as help in dealing with alcohol and drug-related problems, parenting, human relationships, and employee problems. Norris says that training and retraining both workers and management is one way to eliminate low work-quality. Closing the skill gap in each company, and in our country, will require education and training of an unprecedented scale by industry.

Many employees are turned off by the term "productivity" because they perceive it to mean simply that they must work harder, and they fear this may lead to a reduction in the number of workers needed. Some employees think productivity benefits the employer more than the employee. Norris states: "There is an adequate amount of human technology available on how to best respond to the wide varieties of attitudes, needs, interests and motivations of individuals. The deficiency is simply that most managers are not using it." The important thing is for management to share a commitment with its employees to help them achieve personal goals. Management must stress to the employees that, by accomplishing their own goals, they are helping the company to achieve its goals.

James J. Renier, president of Honeywell Inc., believes that ultimately the nation's human resources will answer the problem of stagnant productivity.[16] The management of an organization should recognize Renier's four basic truths about employees:

—Employees want to do a good job.
—Employees want to be recognized as both intelligent and interested in their jobs.
—Employees want to participate in decisions affecting their work.
—Employees want enough information about the plans and goals of their organization to enable them to make informed decisions.

Managers don't have to motivate employees; managers have to create a working environment that permits employees to motivate themselves. Employees want responsibility for the tasks they are assigned and recognition for the tasks they have completed. This gives them a feeling of self-esteem. Renier is convinced that is the greatest motivator there is.

15. William C. Norris in a presentation at the 1980 Fall Conference of the American Institute of Industrial Engineers.
16. James J. Renier in a presentation at the 1980 Fall Conference of the American Institute of Industrial Engineers.

There are several steps that management can take to enhance human resources:

—Generate realistic, challenging, and interesting assignments.

—Tell employees why they are asked to do a particular task or follow a certain procedure.

—Tell employees what is expected of them in each assignment; then, provide feedback on performance of the assignment.

—Provide employees with authority that is commensurate with the responsibility assigned.

—Exchange ideas with employees at every level.

—Involve employees in decision-making that affects their assignments.

Summary

During the '80s, there will be a continuing need for improving the planning and development of human resources. To attract and retain high-caliber employees, management will have to implement effective systems for such planning and development; and will have to inform the work force of the objectives and plans of each team (work group) and how these plans fit into the organization's overall objectives and goals.

There is no one right way to manage; however, in this decade the participative style of management will be the most widely used. Excellence of performance and participative management will reinforce one another. When employees believe that their superiors are concerned with employees' needs and problems, performance will be enhanced. Managers must recognize that they affect the quality of life of subordinates, a social responsibility they can ill afford to neglect.

A statement from a U.S. Department of Labor report issued two decades ago is worthy of our consideration at the start of the decade of the '80s.

> As a nation, we are advancing in technology and know-how at a tremendous rate. How well we shall realize the potential of the advance depends on how effectively our people, as individuals, are able to use the necessary tools at hand. . . . If our [human resources] are to be developed to the full, management must:
>
> 1. Improve individual competence, present and prospective, across the board.
> 2. Use all available [human resources] without regard to race, sex, age or physical handicap.
> 3. Strive to place every employee in a job that best fits his talents and then press for full use of these talents on the job.
> 4. Help every employee develop a sense of purpose and pride in his job.

5. Prepare now for new and changing [human resource] needs within the total work force.[17]

Human resources may not be used fully and efficiently until their value can be measured and managers are held accountable for the effectiveness of human resources development and application. A better understanding of the planning for, and the use of human resources could affect management behavior. I hope this paper contributes to a better understanding of the importance of human resources at the beginning of the '80s, and how the growth of productivity in the United States can be enhanced through the development and effective application of human resources. ||

17. The U.S. Department of Labor report was cited in "Manpower Management in the Sixties," *Personnel*, Vol. 37, No. 2, (March-April 1960), p. 112.

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